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A TWO-STAGE LITTORAL WARFARE SHIP SYSTEM DESIGN

by

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A Systems Engineering approach to the development of a flexible warship system intended for littoral warfare is presented, followed by a description of the preliminary design of the ship shown by analysis to the most cost-effective. The requirements for the project reported were to consider the need to diversify the Navy's current blue water fleet by adding a number of affordable vessels which can be tailored to accomplish specific objectives, as deemed necessary. The ships are to provide flexible response in littoral areas, under an Aegis-ship area air defense umbrella. A "two-stage" approach consisting of a "mother" ship carrying other surface and air craft was considered most effective. In this approach, the flexible, tailored nature of the response is provided by various kinds of "daughter" craft, permitting changing the loadout of the mother ship to respond to current or anticipated needs. The nature of the various daughter craft was arrived at in a previous course; this report concentrates primarily on the definition, feasibility studies and preliminary design of the "mother" ship.

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A TWO STAGE LITTORAL WARFARE SHIP SYSTEM DESIGN

(Specialized Tactical Response and Engagement System: SPECTRE)

This report documents a systems engineering and design capstone project undertaken by students in the Total Ship Systems Engineering (TSSE) program at the Naval Postgraduate School and performed over two academic quarters. The project was under the direction of Prof. C. N. Calvano. (The officer students who comprised the design team were: LCDR Gene Blaylock; LT Robert Burger; LT Eric Hoy; LT Rick Thiel; LT Dave Wagnon; LT Curtis Vejvoda, all U.S. Navy Officers).

ABSTRACT

The Mission Needs Statement given to the design team recognized that future Naval forces would find themselves operating in littoral areas, intervening in regional conflicts and needing to respond to varying kinds of mission demands with flexible forces. It had earlier been agreed by the design team and faculty that a two-stage system, consisting of a "mother" ship which carried numbers of surface and air craft of varying kinds and capabilities offered the most promise for an affordable system that was rapidly re-configurable (by changing the load of carried "2nd stage" craft) to meet unpredictable tactical needs. The mother ship was dubbed the "Carrier Multi-Mission Dock (CMD) and the carried craft, whether air or surface, were called Tactical Patrol Craft (PTX). The combination is referred to as the SPECTRE system. The nature of the PTXs had been examined in an earlier design exercise and craft capable in performing in six warfare areas had been preliminarily defined.

This document reports on the examination of seven potential scenarios for employment of the SPECTRE system, develops the Required Operational Capabilities for the PTX and for the CMD and discusses and justifies a design philosophy to be used to guide the subsequent design effort. The design focus the became primarily the nature of the CMD. A significant effort in threat assessment using the postulated scenarios resulted in a choice of combat system suite alternatives for the CMD itself. In addition, various loadouts of PTXs were examined for the various employment scenarios, and finally the CMD combat system was chosen. The propulsion and other engineering major parameters were decided upon and feasibility studies of three different CMD alternatives, using the Navy's early stage design program (ASSET), were performed. The result of these feasibility studies was a decision to develop further the mid-size CMD alternative.

The second academic quarter was devoted to a preliminary design of the chosen CMD ship alternative. The design team finalized their propulsion plant selection, then defined and analyzed their combat system architecture as well as the architecture for major Hull, Mechanical and Electrical systems. A series of ship arrangements studies was conducted and the Naval Architecture aspects of the ship were examined and verified to be acceptable. The report includes a manning study and numerous drawings of the ship as preliminarily designed. The body of the report concludes with a design team-conducted analysis of their design and is followed by eight appendices giving details and results of various portions of the design investigation.

SECTION I

REQUIREMENTS PHASE

A. MISSION NEED STATEMENT

The overall navy mission has recently changed to emphasize operations in littoral areas, interventions in regional conflicts, and tactical responses with flexible forces. These revised missions reflect the fact that major blue water engagements with other large, technologically advanced navies continue to be considered unlikely, while constrained budgets and scrutinized program costs are a certainty. Consequently, the number of major battle groups will almost definitely decrease, and the number of "low level" conflicts is expected to increase. With respect to specific assets, Aegis-class ships already completed or under contract are expected to provide all the state-of-the-art area AAW warfare capability that the Navy will need until well into the 21st century. However, current ship platforms do not possess the unique abilities to meet the demands of the littoral environment within the constraint of limited financial resources. Thus, diversifying the blue water fleet with a number of affordable vessels tailored to accomplish a specific objective is deemed necessary. The purpose of these specialized ships is to provide a flexible response in littoral areas, under an Aegis umbrella.

B. OPERATIONAL REQUIREMENTS DOCUMENT (ORD)

1. Description of Operational Capability.

In support of the mission need statement, the Chief of Naval Operations (CNO) and the Joint Requirements Oversight Council (JROC) have decided to explore the viability of a "mother ship/scout fighter" combination as the backbone of a Specialized Tactical Response and Engagement (SPECTRE) system. The idea is to deploy a large, simple Carrier Multi-Mission Dock (CMD) ship to a littoral area where a regional conflict is to be deterred or a regional enemy defeated. The CMD would carry a number of smaller Tactical Patrol Craft (PTX), which may be either surface or airborne. The CMD provides long-range, ocean-crossing capability, while the PTX platforms provide most of the combat capability for the combination.

The SPECTRE system consists of a number of PTX platforms, deployed from the CMD, which are configured for a single warfare area only, and have no facilities for a permanent crew. Potential PTX mission areas are: AAW, ASUW, ASW, NGFS, Anti-mine Warfare, and shallow water operations. By placing various mixes of the PTX platforms in the CMD, different capabilities that are tailored to a specific conflict can be provided at the operating area. The CMD will provide all support activities required by the PTXs and their crews, including processing of data and coordination of operations.

Some possible CMD/PTX operational scenarios include:

a. Support of amphibious landings. The CMD will stay over the horizon with the amphibious ships while the PTXs operate to the coast conducting mine clearance operations, coastal surveillance operations, gun fire support operations and anti-air coverage.

b. Protection of anchorages. For an amphibious force anchored off shore, the CMD/PTX system will provide a defensive screen against third world level air, surface, and undersea attacks.

c. Blockading of harbors and restricted waterways. The CMD/PTX combination will maintain patrols and board suspect vessels to enforce embargoes and control shipping.

d. Area mine clearance operations. The CMD/PTX system will provide a deployable mine clearance capability which can operate independently or in support of major operations.

e. Escorting of amphibious or logistics forces. The CMD/PTX, as a secondary mission, will provide protection for such forces in littoral or restricted waterways.

f. Independent PTX operations. This option involves the deployment of PTXs from secure shore facilities vice operating from the CMD. These operations will be primarily police actions such as drug interdiction and smuggling prevention.

2. Threat Summary.

The threat envisioned for this system is primarily from third world nations possessing both modern and capable weapon systems. The majority of these weapons are purchased from nations with significant technological ability such as the United States, China and former members of the Soviet Union. Specifically these threats include:

A. Anti-ship missiles
   1. air launched
   2. ship launched
   3. submarine launched
   4. shore launched

B. Torpedoes

C. Mines

D. Gunfire (small and medium caliber)
   1. ships/boats
   2. shore

E. Chemical, Biological and Nuclear weapons

F. Special Forces

3. Shortcomings of Existing Systems.

Current systems are capable of supporting the Navy's mission against the previously mentioned threats, however there are numerous drawbacks:

A. Cost. Acquisition costs of current ships are enormous (CG47, DDG51, LHD). The loss of a single vessel in a low intensity conflict results in excessive loss of life and financial expense.

B. Inability of present units to provide tailored response in littorals for a specific scenario.

C. Current unit availability does not provide for sufficient area coverage.

D. Currently only the new patrol craft (PC-1) is capable of performing shallow water operations.

4. Range of Capabilities Required.

The proposed CMD/PTX system shall provide the following capabilities:

A. Transit all major waterways.

B. Sustain a 6-month deployment with 3 week UNREP cycle.

C. Sustain combat operations for 3 weeks (same as UNREP cycle).

D. Conduct aircraft operations in sea state 4, boat operations in sea state 3 and UNREP operations in sea sate 5.

E. Provide for interoperability with any Joint Task Force.

F. Operate in mine infested waters.

G. Operate in a CBR environment.

H. Designed for reduced signature (underwater acoustic, airborne acoustic, IR, and electromagnetic).

I. Provide medical capabilities (1 medical surgery, 1 dental chair).

J. Require a maximum of 1000 officers and enlisted personnel.

K. A 50 year life cycle.

L. CMD must have point air defense capability.

M. CMD minimum sustained speed will be 24 kts with a goal of 28 kts.

N. CMD minimum range will be 6000 nm with a goal of 8000 nm at a minimum endurance speed of 16 kts with a goal of 18 kts.

O. CMD displacement will not exceed 40000 tons.

P. CMD will provide Command and Control of PTX operations.

Q. CMD will receive and transmit intelligence data (satellite, RF, HUMINT).

R. CMD will be capable of exchanging tactical information with all joint and allied forces and aircraft.

S. CMD will maintain communication with higher authority at all times.

T. CMD will not exceed $600 million in "first ship" cost (FY 94 dollars).

U. CMD will provide space and accommodations for a small embarked Task Force Commander staff with minimum impact on overall ship volume.

V. CMD will transport and support 4 to 8 PTX surface craft and 2 to 10 PTX aircraft.
W. CMD will not require unusual port / repair / support facilities.
X. Each PTX platform must be capable of supporting one of the following mission areas: AAW, ASW, ASUW, NGFS, mine clearance or coastal surveillance missions.
Y. Surface borne PTX platforms will have only passive ASMD.
Z. Surface borne PTX will have a nominal mission profile of 2 hours transit from CMD to mission area, 8 hours on station, and 2 hours return to CMD transit time.
AA. PTX combat system suite modules shall be airliftable via current assets, and the feasibility of airlifting complete PTX platforms must be explored.

5. Integrated Logistic Support (ILS).

The key factors determining the logistics support requirements for the CMD/PTX system are the required deployment cycle, number of ships in the force, and the ability of the CMD to perform preventive and corrective maintenance on the PTXs. A few of the more important ILS requirements are provided below:

A. CMD must provide full support for PTXs and embarked aircraft for a 6 month deployment (less fuel).
B. CMD will be in phased maintenance: 18 month cycle (90 day duration) with minor overhaul every 12.5 years (9 month duration), and major overhaul every 25 years (18 month duration).
C. Equipment is to be arranged to facilitate ease of maintenance/removal.
D. Minimal crew size is to be achieved.
E. Equipment commonality is required where possible.
F. A high level of onboard training capability is required.

6. Infrastructure Support.

The infrastructure required to operate, maintain and support the CMD/PTX combination will utilize existing systems to the maximum extent possible. This will minimize additional costs incurred due to the "irregularity" of this proposed combat capability. Some of the required support services are:

A. To provide intelligence reports (photo reconnaissance, etc.), charts and maps of projected operational areas to allow for safe navigation and the conduction of mission operations.

B. That ports must provide a means of HAZMAT and trash removal.

7. Force Structure.

The force structure of 10 CMDs total, 5 per coast is envisioned. The CMD/PTX system must be able to be forward deployed.

8. Schedule Considerations.

A preliminary target for ship delivery is dependent upon the availability of ship building assets and technology, however a timeline is provided:

A. The first SPECTRE system must be deployable within 5 years from congressional authorization with an IOC no later than 2007.

B. Follow-on units must be delivered at 1 year intervals thereafter, with an FOC of 2017.

9. Cost Considerations.

The primary consideration for the development of the CMD/PTX concept shall be a system which provides the required warfare capabilities at a competitive cost when compared to current fleet assets.

C. SCENARIOS AND ASSOCIATED THREATS

1. Support of Amphibious Landings (1 Battalion Landing Team).

Situations require an amphibious landing assault onto an opposed beach head. In preparation for the assault, surveillance of potential landing sites, positive location of defense forces and strength assessment is required. Once the primary landing site is identified, mine clearance assets are to be employed to clear the way for boat lanes. During the assault, strike assets are to be available when called to support ground forces and maintain constant patrol of the boat lane perimeter defending against small boat attack on the troop carriers.

A. Threats

1. Mines
2. Shore launched anti-ship missiles
3. Shore gun batteries
4. Air launched anti-ship missiles
5. Surface launched anti-ship missiles

B. Current Operating Force

1. (1) LHD/LPD
2. (2-3) LSD
3. (2-4) surface combatants
4. (0-1) submarines
5. Landing Preparation (mine hunting)
6. Little ASW support

C. Proposed SPECTRE Operating Force

1. (1) LHD/LPD
2. (2-3) LSD
3. (1) AEGIS combatant
4. (1-2) CMD with appropriate PTX mix to perform:
    a. SPEC OPS PATROL (area reconnaisance)
    b. MIW
    c. STRIKE (ASUW and NGFS)
    d. ASW

2. Support of Small Amphibious Landing (Personnel Evacuation, Peacekeeping, etc).

Situations require an amphibious operation for the landing of security forces or the evacuation of personnel. While the landing is not directly opposed with defense forces, some elements of resistance or deterrence can be expected. Surveillance of the landing site and reconnaissance is required. Mine clearance assets may be employed to verify safety of the operations area and landing site. Strike assets are to be available when called to support shore positions and maintain constant patrol of the boat lane perimeter defending against possible terrorist attack.

A. Threats
1. Mines
2. Shore launched anti-ship missiles
3. Shore gun batteries
4. Air launched anti-ship missiles
5. Surface launched anti-ship missiles

B. Current Operating Force
1. (1) LHD and/or LSD
2. (0-1) surface combatants (if air threat is expected)
3. (0-1) submarines
4. Landing Preparation (mine hunting)
5. Little ASW support

C. Proposed SPECTRE Operating Force
1. (1) LHD/LSD
2. (1-2) CMD with appropriate PTX mix to perform:
    a. SPEC OPS PATROL (area reconnaissance)
    b. MIW
    c. STRIKE (AAW, ASUW, NGFS)
    d. ASW

3. Conduct Harbor Blockade (Boarding, Search and Seizure, etc).

Situations require implementing a unilaterally agreed upon sanction against a government by conducting a specific harbor or island nation blockade. Opposition to the embargo is expected in the form of small, isolated organized action and high potential for convert or terrorist activity; thus, the type of threat will be variable. The ability to identify potential blockade runners, conduct boardings for inspection while maintaining cohesive coverage in the operating area will directly impact effectivenss of the mission. Maintaining a high naval presence with many varied platforms will further enhance the embargo's effectiveness but increase opportunity for retalliation. Assets dedicated to actively aquire intelligence will support all facets of the mission.

A. Threats
   1. Mines
   2. Shore launched anti-ship missiles
   3. Shore gun batteries
   4. Air launched anti-ship missiles
   5. Surface launched anti-ship missiles
   6. Sub surface launched anti-ship missiles
   7. Sub surface launched torpedoes

B. Current Operating Force
   1. (1-4) Surface combatants (depending on area of coverage)
   2. (1-2) Coast Guard vessels or detachments
   3. (0-1) submarines

C. Proposed SPECTRE Operating Force
   1. (1-2) CMD with appropriate PTX mix to perform:
      a. SPEC OPS PATROL (area reconnaissance)
      b. STRIKE (AAW, ASUW, NGFS)
      c. MIW
      d. ASW

4. Conduct Area Mine Clearance.

Situations require dedicated mine clearance operation of shipping channel, port or amphibious operating area in short notice. Objective clearance area is located a significant

distance from availabe MIW assets, while their slow speed delays all operations. Once on station, MIW assets require protection in order to conduct their mission efficiently.

A. Threats

1. Mines
2. Shore launched anti-ship missles
3. Shore gun batteries
4. Air launched anti-ship missiles

B. Current Operating Force

1. (1-2) Surface combatants (depending on area of coverage)
2. (1) LHD or LSD to provide support and command and control
3. Heavy lift or tow a specified number of mine sweepers/mine hunters to the area.

C. Proposed SPECTRE Operating Force

1. (1-2) CMD with appropriate PTX mix to perform:
    a. MIW
    b. Command and control with MH-53
    c. STRIKE (ASUW, NGFS, AAW)
    d. SPEC OPS PATROL (area reconnaissance)

5. Conduct Escort Operations in Restricted Waterways.

Situations require protection of merchant shipping traffic in providing safe passage through shipping channel choke point within restricted waterways. Sufficient forces to safely maintain the continuous flow of traffic are necessary. The ability to defend the merchant ships from terrorist attack at any potential vantage point requries capabilities to effectively counter the threats. Continuous survellaince will be important to readily identify and counter opposition.

A. Threats

1. Mines
2. Shore launched anti-ship missiles
3. Shore gun batteries
4. Air launched anti-ship missiles

5. Surface launched anti-ship missiles

B. Current Operating Force

1. (2) Non-AEGIS surface combatants for several escorted ships
2. (1) AEGIS surface combatant to provide area AAW support
3. Continuous mine countermeasure operations to ensure safe path

C. Proposed SPECTRE Operating Force

1. (1) CMD with appropriate PTX mix to perform:
    a. STRIKE (ASUW, AAW, NGFS)
    b. MIW
    c. SPEC OPS PATROL
    d. ASW
2. (1) AEGIS surface combatant to provide area AAW support

6. Conduct Independent PTX Operations.

Situations require deployment of a variety of platforms with specific missions to regions where support services will be provided by existing shore facilities. The means to provide maintenance and supply facilities for the operating platforms is requried.

A. Threats

1. Air launched anti-ship missiles
2. Surface launched anti-ship missiles

B. Current Operating Force

1. (1) Surface combatant or Coast Guard vessel

C. Proposed SPECTRE Operating Force

1. Appropriate PTX mix to perform:
    a. ASUW (surface patrol)
    b. AAW (against aircraft only)

7. Conduct Special Operations (INTEL, RECON, SPECOPS).

Situations require extensive survey and gathering of intelligence of locations that are not easily accessible, except by sea. Operations will include insertion and extraction of reconnaissance forces at a moments notice, continuous monitoring of all electronic activity and survellance along coastal regions in inland waterways.

A. Threats

1. Shore launched anti-ship missiles
2. Shore gun batteries
3. Air launched anti-ship missiles

B. Current Operating Force

1. (1-2) Special Boat Unit (SBU) or (1-2) patrol craft (PC)
2. Shore facilities required to support craft and personnel
3. Lift or tow a specified number of vessels to the area.

C. Proposed SPECTRE Operating Force

1. (1) CMD with appropriate PTX mix to perform:
    a. ASUW (surface patrol)
    b. AAW (close aircraft only)
    c. Strike capability to destroy shore batteries
    d. Personnel and PTX support operations

D. REQUIRED OPERATIONAL CAPABILITIES (ROCs)

The required operational capabilities for the Specialized Tactical Response and Engagement (SPECTRE) system have been segregated into PTX and CMD ROCs. Each platform is designed to accomplish its own set of operational capabilities to ensure that the total system operates to its optimum ability.

1. Tactical Patrol Craft (PTX)

The primary and secondary ROCs for the airborne PTX craft are contained in table 1-1 while those for the surface PTX craft are contained in table 1-2. The ROCs have been seperated to facilitate combat system assessment. Each PTX must perform the capabilities specified under its primary mission area. For example, the AAW designated PTX must provide all the listed capabilities under the AAW ROCs.

The Amphibious Warfare (AMW) ROCs were included to provide for integrated operations between amphibious forces and the SPECTRE system. The SPECTRE concept is not to be used primarily as an amphibious operation platform.

The Mine Warfare (MIW) ROCs MIW 5 and MIW 7 were included to provide the flexibility to lay mines as well as conduct mine countermeasures if the tactical situation determines that mine laying capability is required. In this sense the mine laying ROCs (MIW 5 and MIW 7) are secondary.

2. Carrier Multi-Mission Dock (CMD)

The primary and secondary ROCs for the CMD are contained in table 1-3. It is envisioned that the primary mission of the CMD is to provide the necessary support services to the PTX platforms such as PTX craft maintenance, medical facilities, command and control, haven facilities, and administrative services. The CMD will also carry the necessary ordnance to replenish the PTX craft in the mission they are assigned.

The CMD will be equipped to provide for self defense capability to include the use of decoys. The primary and secondary ROCs for the CMD will fluctuate depending on the assigned mission of the SPECTRE system. ROCs may be primary in one scenario but may be secondary in a different scenario.

TABLE 1-1

AIRBORNE PTX PRIMARY AND SECONDARY REQUIRED OPERATIONAL CAPABILITIES

Reference: OPNAVINST C3501.2H, Naval Warfare Mission Areas and Require Operational Capability/Projected Operational Environment (ROC/POE)

ANTI-AIR WARFARE (AAW). the destruction or neutralization of enemy air platforms and airborne weapons, whether launched from air, surface, subsurface or land platforms.

AAW 1 Provide anti-air defense in cooperation with other forces.
- AAW 1.2 Provide self-defense.
- AAW 1.5 Support area defense for amphibious forces in transit and in Amphibious Objective Area (AOA).
- AAW 1.6 Support area defense for a Surface Action Group (SAG).

AAW 2 Provide anti-air defense of a geographic area (zone) in cooperation with other forces.

AAW 3 Engage air targets in cooperation with other forces.

AAW 5 Conduct airborne anti-air operations.
- AAW 5.1 Conduct airborne anti-air cyclic operations.
- AAW 5.3 Employ defensive tactics against air attack.
- AAW 5.5 See Reference.

AAW 6 Detect, identify and track air targets.
- AAW 6.2 Recognize by sight, friendly/enemy aircraft which may be encountered in expected operating areas.

AAW 8 Engage air targets using installed air-to-air weapons systems.
- AAW 8.1 Engage air targets using all weather intercept system.
- AAW 8.3 Engage air targets using SIDEWINDER system.
- AAW 8.5 Engage air targets using guns.

AMPHIBIOUS WARFARE (AMW). Attacks, launched from the sea by naval forces and by landing forces embarked in ships or craft, designed to achieve a landing on a hostile shore. This includes fire support of troops in contact with enemy forces through the use of close air support or shore bombardment.

AMW 6 Conduct helicopter operations in support of amphibious assault.
- AMW 6.1 Conduct day helo flight operations.
- AMW 6.2 Conduct night helo flight operations.
- AMW 6.5 Conduct helo flight operations during all EMCON conditions.
- AMW 6.6 Conduct helo hot and cold refueling operations.

AMW 8 Provide for surface/subsurface defense of an AOA.

AMW 9 Conduct pre-assault cover and diversionary actions.

ANTI-SURFACE WARFARE (ASU). The destruction or neutralization of enemy surface combatants and merchant ships.

ASU 1 Engage surface threats with anti-surface weapons.
- ASU 1.2 Engage surface ships with medium range cruise missiles.
- ASU 1.6 Engage surface ships with minor caliber gunfire. (i.e. 25mm, 20mm, .50 cal)
- ASU 1.7 Illuminate surface ships with guns.
- ASU 1.8 Engage surface ships with medium range missiles.
- ASU 1.9 Engage surface ships with small arms gunfire.

ASU 2 Engage surface targets during BG operations in cooperation with other forces.
- ASU 2.2 Operate in direct support of surface forces.
- ASU 2.4 Operate in coordination with land and sea based air forces in conducting long range surface actions.

ASU 3 Support anti-surface ship defense of a geographical area (e.g. zone or barrier) in cooperation with other forces.

ASU 4 Detect, identify, localize and track surface targets.

- ASU 4.4 Detect and track surface contacts visually.
- ASU 4.5 Detect, identify, localize and track surface targets with infrared.
- ASU 4.6 Detect, identify, localize and track surface targets by ESM.
- ASU 4.7 Identify surface contacts.
- ASU 4.11 Prosecute attack using Link 4A targeting information.

ASU 6 Disengage, evade and avoid surface attack.
- ASU 6.1 Employ countermeasures.
- ASU 6.2 Employ evasion techniques.
- ASU 6.3 Employ EMCON procedures.

ASU 9 Conduct attacks on surface ships using air launched armament.
- ASU 9.1 Attack surface ships using nuclear or conventional armament in an all weather environment.
- ASU 9.2 Attack surface ships using nuclear or conventional armament in day visual environment.
- ASU 9.3 Attack surface ships using nuclear or conventional armament in night visual environment.
- ASU 9.4 Attack surface ships using air-to-surface guided missiles or anti-radiation weapons systems.
- ASU 9.6 Attack surface ships using guided or unguided free fall weapon systems.
- ASU 9.8 Evade hostile surface-to-air threats.

ASU 10 Conduct airborne operations in support of anti-surface attack operations.
- ASU 10.3 Conduct defense suppression in support of air attack operations.
- ASU 10.4 Conduct flight operations during all EMCON conditions.
- ASU 10.5 Provide over-the-horizon (OTH) targeting information in support of air attack operations.

ASU 12 Support and conduct independent ASU operations.
- ASU 12.1 Conduct ASU operations while escorting a convoy and/or URG.
- ASU 12.2 Conduct ASU operations while escorting ATF or protecting an AOA.
- ASU 12.3 Conduct ASU self-defense operations.

ASU 13 Conduct pre-attack deception operations.

ANTI-SUBMARINE WARFARE (ASW). The destruction or Neutralization of enemy submarines.

ASW 1 Provide ASW defense against submarines for surface forces, groups and units.
- ASW 1.1 Screen a convoy (military or mercantile).
- ASW 1.3 Screen transitting amphibious forces or an underway replenishment group.
- ASW 1.4 Operate in direct support of surface forces.
- ASW 1.5 Operate in associated support of surface forces.

ASW 2 Provide ASW defense of a geographic area.
- ASW 2.1 Operate as a choke point ASW search/barrier unit.
- ASW 2.2 Operate as an inshore harbor defense ASW barrier.
- ASW 2.3 Operate as an AOA ASW defense barrier.
- ASW 2.5 Sanitize an area of threat submarines in preparation for use by surface forces.

ASW 3 Conduct independent ASW operations.
- ASW 3.1 See Reference.
- ASW 3.2 See Reference.

ASW 4 Conduct airborne anti-submarine operations.
- ASW 4.1 Conduct day and night, all-weather, airborne anti-submarine cyclic operations.
- ASW 4.3 Provide information to surface units utilizing data link.
- ASW 4.4 Provide information to other ASW aircraft utilizing data link.
- ASW 4.6 Conduct long-range ASW operations.

ASW 6 Engage submarines in cooperation with other forces.
- ASW 6.3 Operate in direct support of surface forces.
- ASW 6.4 See Reference.

ASW 6.5 See Reference.
ASW 6.6 See Reference.
ASW 6.7 See Reference.
ASW 6.8 See Reference.
ASW 6.10 See Reference.
ASW 6.12 See Reference.
ASW 6.14 See Reference.
ASW 6.15 See Reference.

ASW 7 Engage submarines with anti-submarine armament.
ASW 7.6 See Reference.
ASW 7.7 Attack with air launched missiles.
ASW 7.9 Attack with guns.
ASW 7.11 Attack with conventional air-to-surface ordnance.

ASW 8 Disengage, evade, avoid, and deceive submarines.
ASW 8.4 Conduct deception operations in support of ASW operations.

COMMAND, CONTROL AND COMMUNICATIONS (CCC). Providing communications and related facilities for coordination and control of external organizations or forces and control of unit's own facilities.

CCC 3 Provide own unit's command and control functions.
CCC 3.3 Provide all necessary personnel services, programs, and facilities to safeguard classified material and information.
CCC 3.4 Carry out emergency destruction of classified matter and equipment rapidly and efficiently.
CCC 3.5 Employ Identification Friend or Foe/Selective Identification Feature (IFF/SIF) secure IFF mode 4.

CCC 4 Maintain Navy Tactical Data System (NTDS) or data link capability.
CCC 4.3 Transmit/receive and support Link 11.
CCC 4.10 Transmit/receive and correlate targeting information with Link 4A.

CCC 6 Provide communications for own unit.
CCC 6.1 Provide tactical voice communications.
CCC 6.12 Provide internal communications systems.
CCC 6.16 Provide tactical, secure, anti-jam Ultra-High Frequency (UHF) voice communications.
CCC 6.17 Provide tactical, secure, anti-jam Very-High Frequency (VHF) voice communications.
CCC 6.18 Provide tactical, secure, anti-jam HF voice communications.
CCC 6.19 Provide tactical, secure voice or data communications.

CCC 7 Implement Operations Security (OPSEC) measures and conduct military deception actions.
CCC 7.1 Plan, coordinate and control implementation of OPSEC measures.
CCC 7.2 Execute OPSEC measures.
CCC 7.3 Plan, coordinate and control Navy operational deception operations.
CCC 7.4 Execute Navy operational deception actions using tactics, operations, exercises or physical means.

CCC 9 Relay Naval communications with visual and electronic means.
CCC 9.3 Relay electronic communications.

CCC 13 Provide communications support for tactical surface, submarine and air units.
CCC 13.22 Provide Search and Rescue (SAR) communications support.

ELECTRONIC WARFARE (ELW). The effective use by friendly forces of the electromagnetic spectrum for detection and targeting while deterring, exploiting, reducing or denying its use by the enemy.

ELW 1 See Reference.
ELW 1.1 See Reference.
ELW 1.2 See Reference.
ELW 1.3 See Reference.

ELW 1.4 See Reference.
ELw 1.5 See Reference.

ELW 2 See Reference.
ELW 2.2 See Reference.
ELW 2.4 See Reference.
ELW 2.6 See Reference.
ELW 2.7 See Reference.
ELW 2.10 See Reference.

ELW 3 See Reference.
ELW 3.1 See Reference.
ELW 3.2 See Reference.

ELW 4 See Reference.
ELW 4.1 See Reference.
ELW 4.2 See Reference.
ELW 4.3 See Reference.

ELW 5 See Reference.

ELW 6 See Reference.
ELW 6.1 See Reference.

ELW 7 See Reference.
ELW 7.1 See Reference.

ELW 8 Conduct Electronic Warfare Support Measures operations in support of integrated strike training.

ELW 9 Conduct Electronic Countermeasure operations in support of integrated strike training.

ELW 10 Conduct Electronic Counter-Countermeasure operations in support of integrated strike training.

INTELLIGENCE (INT). The collection, processing, and evaluation of information to determine location, identification and capability of hostile forces through the employment of reconnaisance, surveillance, and other means.

INT 1 See Reference.
INT 1.1 See Reference.
INT 1.4 See Reference.
INT 1.5 See Reference.

MINE WARFARE (MIW). The use of mines for control/denial of sea or harbor areas, and mine countermeasures to destroy or neutralize enemy mines.

MIW 1 See Reference.
MIW 1.1 See Reference.
MIW 1.2 See Reference.
MIW 1.3 See Reference.
MIW 1.6 See Reference.

MIW 2 Conduct influence mine countermeasures.
MIW 1.1 Sweep magnetic mines.
MIW 2.2 Sweep acoustic mines.
MIW 2.3 Sweep pressure mines.
MIW 2.4 Sweep underwater electrical potential mines.
MIW 2.5 Sweep magnetic/acoustic combination influence mines.
MIW 2.6 Sweep magnetic/pressure combination influence mines.
MIW 2.7 Sweep acoustic/pressure combination influence mines.
MIW 2.8 Sweep magnetic/pressure/acoustic combination influence mines.

MIW 3 Conduct mine neutralization/destruction.
MIW 3.2 Destroy floating mines.

MIW 4 Conduct mine countermeasures (MCM).
MIW 4.1 Detect, classify and plot sea mines.
MIW 4.2 Vector small craft to mark locataed mine like objects.

MIW 4.7 Conduct trawl sweep operations to clear/neutralize bottom mines.

MIW 5 Support/conduct offensive/defensive service and exercise mine-laying operations.

MIW 5.2 Support/conduct mine laying operations by aircraft in a hostile environment.

MIW 9 Conduct airborne mine countermeasures.

MIW 9.1 Conduct day helo AMCM flight operations.

MIW 9.2 See Reference.

MIW 9.4 Provide MCM gear to support MCM operations.

MIW 11 Conduct Route Survey Operations.

MIW 11.2 Conduct RSO by AMCM rotary aircraft.

MIW 11.3 Provide capability to collect, store, retrieve, and process MIW contact information.

MOBILITY (MOB). The ability of naval forces to move and to maintain themselves in all situations over, under or upon the surface.

MOB 3 Prevent and control damage.

Mob 3.2 Counter and control CBR contamination/agents.

Mob 3.3 Maintain security against unfriendly acts.

MOB 7 Perform seamanship, airmanship and navigation tasks.

MOB 7.9 Operate day and night and under all weather conditions.

MOB 7.15 Operate in a chemically contaminated environment

MOB 8 Operate from a ship.

MOB 8.2 Operate from a ship with a helicopter platform.

STRIKE WARFARE (STW). Support the destruction or neutralization of enemy targets ashore through the use of conventional weapons.

STW 3 Support/conduct multiple cruise missile strikes either independently or in support of other strike forces.

STW 3.2 Support/conduct conventionally armed cruise missile strikes.

TABLE 1-2

SURFACE PTX PRIMARY AND SECONDARY REQUIRED OPERATIONAL CAPABILITIES

Reference: OPNAVINST C3501.2H, Naval Warfare Mission Areas and Require Operational Capability/Projected Operational Environment (ROC/POE)

ANTI-AIR WARFARE (AAW). the destruction or neutralization of enemy air platforms and airborne weapons, whether launched from air, surface, subsurface or land platforms.

AAW 1 Provide anti-air defense in cooperation with other forces.
- AAW 1.2 Provide self-defense.
- AAW 1.5 Support area defense for amphibious forces in transit and in Amphibious Objective Area (AOA).
- AAW 1.6 Support area defense for a Surface Action Group (SAG).

AAW 2 Provide anti-air defense of a geographic area (zone) in cooperation with other forces.

AAW 3 Engage air targets in cooperation with other forces.

AAW 6 Detect, identify and track air targets.
- AAW 6.2 Recognize by sight, friendly/enemy aircraft which may be encountered in expected operating areas.
- AAW 6.5 Detect, identify and track air targets with radar.
- AAW 6.6 Acquire and track targets with Gun Fire Control System/Missile Fire Control System (GFCS/MFCS).

AAW 9 Engage airborne threats using surface-to-air armament.
- AAW 9.5 Engage airborne threats using installed anti-air weapons.
- AAW 9.6 See reference.
- AAW 9.7 Engage airborne threats using portable missile systems.

AMPHIBIOUS WARFARE (AMW). Attacks, launched from the sea by naval forces and by landing forces embarked in ships or craft, designed to achieve a landing on a hostile shore. This includes fire support of troops in contact with enemy forces through the use of close air support or shore bombardment.

AMW 6 Conduct helicopter operations in support of amphibious assault.
- AMW 6.1 Conduct day helo flight operations.
- AMW 6.2 Conduct night helo flight operations.
- AMW 6.5 Conduct helo flight operations during all EMCON conditions.
- AMW 6.6 Conduct helo hot and cold refueling operations.

AMW 8 Provide for surface/subsurface defense of an AOA.

AMW 9 Conduct pre-assault cover and diversionary actions.

AMW 14 Support/conduct Naval Gunfire Support (NGFS) against designated targets in support of an amphibious operation.
- AMW 14.1 Conduct shore bombardment with conventional weapons
- AMW 14.3 Conduct direct fire.
- AMW 14.4 Conduct indirect fire
- AMW 14.5 Conduct simultaneous illumination and destructive fire.

AMW 18 Conduct Inshore Undersea Warfare (IUW) operations.

ANTI-SURFACE WARFARE (ASU). The destruction or neutralization of enemy surface combatants and merchant ships.

ASU 1 Engage surface threats with anti-surface weapons.
- ASU 1.2 Engage surface ships with medium range cruise missiles.
- ASU 1.5 Engage surface ships with intermediate caliber gunfire. (i.e. 3"/75, 76mm)
- ASU 1.6 Engage surface ships with minor caliber gunfire. (i.e. 25mm, 20mm, .50 cal)
- ASU 1.7 Illuminate surface ships with guns.
- ASU 1.8 Engage surface ships with medium range missiles.
- ASU 1.9 Engage surface ships with small arms gunfire.

ASU 2 Engage surface targets during BG operations in cooperation with other forces.
- ASU 2.1 Operate as a member of a multi-ship SAG.
- ASU 2.2 Operate in direct support of surface forces.
- ASU 2.4 Operate in coordination with land and sea based air forces in conducting long range surface actions.

ASU 3 Support anti-surface ship defense of a geographical area (e.g. zone or barrier) in cooperation with other forces.

ASU 4 Detect, identify, localize and track surface targets.
- ASU 4.1 Detect, identify, localize and track surface targets with radar.
- ASU 4.4 Detect and track surface contacts visually.
- ASU 4.5 Detect, identify, localize and track surface targets with infrared.
- ASU 4.6 Detect, identify, localize and track surface targets by ESM.
- ASU 4.7 Identify surface contacts.
- ASU 4.11 Prosecute attack using Link 4A targeting information.

ASU 6 Disengage, evade and avoid surface attack.
- ASU 6.1 Employ countermeasures.
- ASU 6.2 Employ evasion techniques.
- ASU 6.3 Employ EMCON procedures.

ASU 10 Conduct airborne operations in support of anti-surface attack operations.
- ASU 10.3 Conduct defense suppression in support of air attack operations.
- ASU 10.4 Conduct flight operations during all EMCON conditions.
- ASU 10.5 Provide over-the-horizon (OTH) targeting information in support of air attack operations.

ASU 12 Support and conduct independent ASU operations.
- ASU 12.1 Conduct ASU operations while escorting a convoy and/or URG.
- ASU 12.2 Conduct ASU operations while escorting ATF or protecting an AOA.
- ASU 12.3 Conduct ASU self-defense operations.

ASU 13 Conduct pre-attack deception operations.

ANTI-SUBMARINE WARFARE (ASW). The destruction or Neutralization of enemy submarines.

ASW 1 Provide ASW defense against submarines for surface forces, groups and units.
- ASW 1.1 Screen a convoy (military or mercantile).
- ASW 1.3 Screen transitting amphibious forces or an underway replenishment group.
- ASW 1.4 Operate in direct support of surface forces.
- ASW 1.5 Operate in associated support of surface forces.
- ASW 1.6 Operate as a member of a multi-platform search and attack unit (SAU).

ASW 2 Provide ASW defense of a geographic area.
- ASW 2.1 Operate as a choke point ASW search/barrier unit.
- ASW 2.2 Operate as an inshore harbor defense ASW barrier.
- ASW 2.3 Operate as an AOA ASW defense barrier.
- ASW 2.5 Sanitize an area of threat submarines in preparation for use by surface forces.

ASW 3 Conduct independent ASW operations.
- ASW 3.1 See Reference.
- ASW 3.2 See Reference.

ASW 6 Engage submarines in cooperation with other forces.
- ASW 6.1 Operate as a member of a multi-ship Search and Attack Unit (SAU).
- ASW 6.2 Operate as a member of a combined surface and aviation SAU.
- ASW 6.4 See Reference.
- ASW 6.5 See Reference.
- ASW 6.6 See Reference.
- ASW 6.7 See Reference.
- ASW 6.8 See Reference.
- ASW 6.10 See Reference.

ASW 6.12 See Reference.
ASW 6.14 See Reference.
ASW 6.15 See Reference.

ASW 7 Engage submarines with anti-submarine armament.
ASW 7.6 See Reference.

ASW 8 Disengage, evade, avoid, and deceive submarines.
ASW 8.1 Employ torpedo countermeasures and evasion techniques.
ASW 8.4 Conduct deception operations in support of ASW operations.

COMMAND, CONTROL AND COMMUNICATIONS (CCC). Providing communications and related facilities for coordination and control of external organizations or forces and control of unit's own facilities.

CCC 3 Provide own unit's command and control functions.
CCC 3.3 Provide all necessary personnel services, programs, and facilities to safeguard classified material and information.
CCC 3.4 Carry out emergency destruction of classified matter and equipment rapidly and efficiently.
CCC 3.5 Employ Identification Friend or Foe/Selective Identification Feature (IFF/SIF) secure IFF mode 4.

CCC 4 Maintain Navy Tactical Data System (NTDS) or data link capability.
CCC 4.3 Transmit/receive and support Link 11.
CCC 4.4 Receive data link information from airborne ASW aircraft.

CCC 6 Provide communications for own unit.
CCC 6.1 Provide tactical voice communications.
CCC 6.2 Provide visual communications.
CCC 6.12 Provide internal communications systems.
CCC 6.16 Provide tactical, secure, anti-jam Ultra-High Frequency (UHF) voice communications.
CCC 6.17 Provide tactical, secure, anti-jam Very-High Frequency (VHF) voice communications.
CCC 6.18 Provide tactical, secure, anti-jam HF voice communications.
CCC 6.19 Provide tactical, secure voice or data communications.

CCC 7 Implement Operations Security (OPSEC) measures and conduct military deception actions.
CCC 7.1 Plan, coordinate and control implementation of OPSEC measures.
CCC 7.2 Execute OPSEC measures.
CCC 7.3 Plan, coordinate and control Navy operational deception operations.
CCC 7.4 Execute Navy operational deception actions using tactics, operations, exercises or physical means.
CCC 7.6 Execute military deception actions using technical means (electronic, acoustic, visual, Electrical/Optical (E/O)).

CCC 9 Relay Naval communications with visual and electronic means.
CCC 9.1 Relay visual communications.
CCC 9.3 Relay electronic communications.

CCC 13 Provide communications support for tactical surface, submarine and air units.
CCC 13.12 Provide Harbor Common voice net support.
CCC 13.22 Provide Search and Rescue (SAR) communications support.

ELECTRONIC WARFARE (ELW). The effective use by friendly forces of the electromagnetic spectrum for detection and targeting while deterring, exploiting, reducing or denying its use by the enemy.

ELW 1 See Reference.
ELW 1.1 See Reference.
ELW 1.2 See Reference.
ELW 1.3 See Reference.
ELW 1.4 See Reference.
ELw 1.5 See Reference.

ELW 2 See Reference.

ELW 2.2 See Reference.
ELW 2.4 See Reference.
ELW 2.6 See Reference.
ELW 2.7 See Reference.
ELW 2.10 See Reference.

ELW 3 See Reference.

ELW 3.1 See Reference.
ELW 3.2 See Reference.

ELW 4 See Reference.

ELW 4.1 See Reference.
ELW 4.2 See Reference.
ELW 4.3 See Reference.

ELW 5 See Reference.

ELW 6 See Reference.

ELW 6.1 See Reference.

ELW 7 See Reference.

ELW 7.1 See Reference.

ELW 8 Conduct Electronic Warfare Support Measures operations in support of integrated strike training.

ELW 9 Conduct Electronic Countermeasure operations in support of integrated strike training.

ELW 10 Conduct Electronic Counter-Countermeasure operations in support of integrated strike training.

FLEET SUPPORT OPERATIONS (FSO). Naval forces and designated shore facilities providing supporting services other than logistics replenishment to fleet units.

FSO 7 Provide explosive ordnance disposal (EOD) services.

FSO 7.8 Recover and conduct initial technical evaluation of ordnance encountered underwater.
FSO 7.9 Conduct ordnance disposal and demolition operations.
FSO 7.11 Detect the presence of chemical agents.
FSO 7.21 Conduct small craft operations in support of EOD missions.

INTELLIGENCE (INT). The collection, processing, and evaluation of information to determine location, identification and capability of hostile forces through the employment of reconnaisance, surveillance, and other means.

INT 1 See Reference.

INT 1.1 See Reference.
INT 1.4 See Reference.
INT 1.5 See Reference.

INT 3 Conduct surveillance and reconnaissance.

INT 3.1 See Reference.
INT 3.2 Conduct overt surveillance and reconnaissance operations.
INT 3.3 See Reference.

INT 6 Conduct surface reconnaissance.

INT 6.1 Conduct surface patrols or barriers.
INT 6.2 Conduct strike reconnaissance on hostile shore lines.
INT 6.5 Conduct inshore harbor defense patrols.

MINE WARFARE (MIW). The use of mines for control/denial of sea or harbor areas, and mine countermeasures to destroy or neutralize enemy mines.

MIW 1 See Reference.

MIW 1.1 See Reference.
MIW 1.2 See Reference.
MIW 1.3 See Reference.
MIW 1.6 See Reference.

MIW 2 Conduct influence mine countermeasures.

- MIW 1.1 Sweep magnetic mines.
- MIW 2.2 Sweep acoustic mines.
- MIW 2.3 Sweep pressure mines.
- MIW 2.4 Sweep underwater electrical potential mines.
- MIW 2.5 Sweep magnetic/acoustic combination influence mines.
- MIW 2.6 Sweep magnetic/pressure combination influence mines.
- MIW 2.7 Sweep acoustic/pressure combination influence mines.
- MIW 2.8 Sweep magnetic/pressure/acoustic combination influence mines.

MIW 3 Conduct mine neutralization/destruction.

- MIW 3.1 Neutralize located mines.
- MIW 3.2 Destroy floating mines.
- MIW 3.3 Destroy subsurface mines.
- MIW 3.4 Recover enemy mines.
- MIW 3.6 Provide support for embarked EOD/SEAL.

MIW 4 Conduct mine countermeasures (MCM).

- MIW 4.1 Detect, classify and plot sea mines.
- MIW 4.3 Neutralize moored sea mines.
- MIW 4.4 Neutralize bottom sea mines.
- MIW 4.7 Conduct trawl sweep operations to clear/neutralize bottom mines.

MIW 5 Support/conduct offensive/defensive service and exercise mine-laying operations.

- MIW 5.1 Support/conduct service and exercise mine-laying operations by surface ships.
- MIW 5.5 Conduct min-laying ooperations with SEAL team.

MIW 6 Conduct magnetic silencing (degaussing, deperming, etc).

- MIW 6.7 Maintain magnetic signature limits.

MIW 8 Conduct precise navigation.

- MIW 8.2 Navigate precisely in MCM environment.
- MIW 8.3 Navigate precisely in mine laying environment.
- MIW 8.5 Safely navigate minefields.

MIW 11 Conduct Route Survey Operations.

- MIW 11.1 Conduct RSO by SMCM ships/craft.
- MIW 11.3 Provide capability to collect, store, retrieve, and process MIW contact information.

MOBILITY (MOB). The ability of naval forces to move and to maintain themselves in all situations over, under or upon the surface.

MOB 3 Prevent and control damage.

- Mob 3.1 Control fire, flooding, electrical, structural, propulsion and hull casualties.
- Mob 3.2 Counter and control CBR contamination/agents.
- Mob 3.3 Maintain security against unfriendly acts.
- Mob 3.5 Provide DC security and surveillance.
- Mob 3.8 Provide emergency breathing devices per ship's allowance.

MOB 5 Maneuver in formation.

MOB 7 Perform seamanship, airmanship and navigation tasks.

- MOB 7.1 Navigate under all conditions of geographic location, weather, and visibility.
- MOB 7.6 Abandon/scuttle ship rapidly
- MOB 7.7 Provide life boat/raft capacity IAW unit's allowance
- MOB 7.8 Tow or be towed.
- MOB 7.9 Operate day and night and under all weather conditions.
- MOB 7.14 Moor alongside ATF shipping or docks.
- MOB 7.15 Operate in a chemically contaminated environment

MOB 8 Operate from a ship.

- MOB 8.8 Operate from a well deck equipped amphibious ship.

MOB 12 Maintain the health and well-being of the crew.

MOB 12.2 Ensure the operation of the potable water system in a manner consistent with approved sanitary procedures and standards.

MOB 12.3 Maintain the environment to ensure the protection of personnel from overexposure to hazardous levels of radiation, temperature, noise, vibration, and toxic substances per current instructions.

MOB 12.6 Ensure operation and maintenance of all phases of shipboard environmental protection systems do not create a health hazardand are consistent with other naval directives pertaining to the prevention of pollution of the environment.

STRIKE WARFARE (STW). Support the destruction or neutralization of enemy targets ashore through the use of conventional weapons.

STW 3 Support/conduct multiple cruise missile strikes either independently or in support of other strike forces.

STW 3.2 Support/conduct conventionally armed cruise missile strikes.

TABLE 1-3

CMD PRIMARY AND SECONDARY REQUIRED OPERATIONAL CAPABILITIES

Reference: OPNAVINST C3501.2H, Naval Warfare Mission Areas and Require Operational Capability/Projected Operational Environment (ROC/POE)

ANTI-AIR WARFARE (AAW). the destruction or neutralization of enemy air platforms and airborne weapons, whether launched from air, surface, subsurface or land platforms.

AAW 1 Provide anti-air defense in cooperation with other forces.

AAW 1.2 Provide self-defense.

AAW 4 Provide for air operations in support of airborne anti-air operations.

AAW 4.1 Launch fixed wing and/or rotary wing aircraft involved in anti-air operations.

AAW 4.2 Recover fixed wing and/or rotary wing aircraft involved in anti-air operations.

AAW 4.5 Provide required conventional ordnance to support anti-air operations.

AAW 4.7 Load/unload ordnance compatible with required aircraft turnaround times.

AAW 6 Detect, identify and track air targets.

AAW 6.2 Recognize by sight, friendly/enemy aircraft which may be encountered in expected operating areas.

AAW 6.3 Maintain accurate air plot.

AAW 6.4 Measure aircraft altitude by radar.

AAW 6.5 Detect, identify and track air targets with radar.

AAW 6.6 Acquire and track targets with Gun Fire Control System/Missile Fire Control System (GFCS/MFCS).

AAW 6.7 See Reference.

AAW 6.8 See Reference.

AAW 6.10 See Reference.

AAW 9 Engage airborne threats using surface-to-air armament.

AAW 9.5 Engage airborne threats using installed anti-air weapons.

AAW 9.6 See reference.

AMPHIBIOUS WARFARE (AMW). Attacks, launched from the sea by naval forces and by landing forces embarked in ships or craft, designed to achieve a landing on a hostile shore. This includes fire support of troops in contact with enemy forces through the use of close air support or shore bombardment.

AMW 6 Conduct helicopter operations in support of amphibious assault.

AMW 6.1 Conduct day helo flight operations.

AMW 6.2 Conduct night helo flight operations.

AMW 6.4 Provide required conventional ordnance to support amphibious operations.

AMW 6.5 Conduct helo flight operations during all EMCON conditions.

AMW 6.6 Conduct helo hot and cold refueling operations.

AMW 6.7 Serve as helo haven.

AMW 6.8 Provide electric power for helo starting, testing, etc.

AMW 12 Provide air control and coordination of air operations in an AOA.

AMW 12.2 Provide coordination of AAW, ASU, and ASW air assets for protection of the force in an AOA.

AMW 12.3 Control air search and rescue operations in an AOA.

AMW 12.4 Coordinate air assets in the AOA with supporting arms to provide safe, coordinated action.

ANTI-SURFACE WARFARE (ASU). The destruction or neutralization of enemy surface combatants and merchant ships.

ASU 1 Engage surface threats with anti-surface weapons.

ASU 1.6 Engage surface ships with minor caliber gunfire. (i.e. 25mm, 20mm, .50 cal)

ASU 2 Engage surface targets during BG operations in cooperation with other forces.

ASU 2.1 Operate as a member of a multi-ship SAG.
ASU 2.2 Operate in direct support of surface forces.

ASU 4 Detect, identify, localize and track surface targets.
ASU 4.1 Detect, identify, localize and track surface targets with radar.
ASU 4.4 Detect and track surface contacts visually.
ASU 4.6 Detect, identify, localize and track surface targets by ESM.
ASU 4.7 Identify surface contacts.
ASU 4.8 Detect and track surface contacts by Radio Direction Finding (OUTBOARD or Combat DF).

ASU 6 Disengage, evade and avoid surface attack.
ASU 6.1 Employ countermeasures.
ASU 6.2 Employ evasion techniques.
ASU 6.3 Employ EMCON procedures.

ASU 8 Provide for air operations in support of anti-surface attack operations.
ASU 8.1 Launch fixed and/or rotary wing aircraft in support of anti-surface operations.
ASU 8.2 Recover fixed and/or rotary wing aircraft in support of anti-surface operations.
ASU 8.5 Provide required conventional ordnance to support anti-surface attack operations.
ASU 8.8 Control aircraft under all condtions of active jamming.
ASU 8.9 Load/unload ordnance compatible with required aircraft turnaround times.
ASU 8.10 Provide air strike control to direct or assist attack aircraft.

ASU 10 Conduct airborne operations in support of anti-surface attack operations.
ASU 10.4 Conduct flight operations during all EMCON conditions.

ASU 12 Support and conduct independent ASU operations.
ASU 12.3 Conduct ASU self-defense operations.

ASU 13 Conduct pre-attack deception operations.

ANTI-SUBMARINE WARFARE (ASW). The destruction or Neutralization of enemy submarines.

ASW 1 Provide ASW defense against submarines for surface forces, groups and units.
ASW 1.4 Operate in direct support of surface forces.
ASW 1.5 Operate in associated support of surface forces.

ASW 3 Conduct independent ASW operations.
ASW 3.1 See Reference.
ASW 3.2 See Reference.

ASW 5 Provide for air operations in support of airborne anti-submarine operations.
ASW 5.1 Launch fixed wing and/or rotary wing aircraft involved in anti-submarine operations.
ASW 5.2 Recover fixed wing and/or rotary wing aircraft involved in anti-submarine operations.
ASW 5.4 Provide required conventional ordnance to support anti-submarine operations.
ASW 5.6 Conduct operations during all EMCON conditions.
ASW 5.7 Load/unload ordnance compatible with required aircraft turnaround times.
ASW 5.8 See Reference.
ASW 5.9 Control fixed wing and/or rotary wing ASW aircraft in conjunction with coordinated search and/or attack operations.
ASW 5.10 Control helicopter screen.
ASW 5.11 Provide positive and/or advisory control of ASW aircraft.

ASW 7 Engage submarines with anti-submarine armament.
ASW 7.9 Attack with guns.

ASW 8 Disengage, evade, avoid, and deceive submarines.
ASW 8.1 Employ torpedo countermeasures and evasion techniques.
ASW 8.2 Employ ACM against submarines.
ASW 8.4 Conduct deception operations in support of ASW operations.

COMMAND, CONTROL AND COMMUNICATIONS (CCC). Providing communications and related facilities for coordination and control of external organizations or forces and control of unit's own

facilities.

CCC 1 Provide command and control facilities for a task organization commander and staff.

- CCC 1.1 Adequately support (spaces, facilities, and equipment only) embarked Warfare Commander or Coordinator (other than own unit Commanding Officer).
- CCC 1.2 Provide adequate command and control facilities for embarked Warfare Commander or Coordinator (other than own unit Commanding Officer).
- CCC 1.5 Provide a Tactical Air Control Center (TACC) or Tactical Air Direction Center (TADC), as appropriate, with facilities for the tactical air officer and/or tactical air controller and his staff. Facilities are required for the control and coordination of AAW, ASW, and MIW and multi-deck helicopter operations.
- CCC 1.9 Provide a signal/electronic warfare coordination center with facilities for operations and intelligence personnel.
- CCC 1.10 Provide a Helicopter Logistic Support Center with facilities for the Helicopter Logistic Coordinator (HLC) and supporting personnel.
- CCC 1.14 Provide a Combat Information Center (CIC) with facilities for a Staff Watch Officer (SWO).

CCC 2 Coordinate and control the operations of the task organization or functional force to carry out assigned missions.

- CCC 2.1 Coordinate the reconnaissance of multiple surface, subsurface, and/or air contacts.
- CCC 2.2 Function as AAWC for force or sector.
- CCC 2.3 Function as ASWC for force or sector.
- CCC 2.4 Function as SAU or SAG commander.
- CCC 2.5 Operate as contact area commander to coordinate multi-type search and attack operations.
- CCC 2.8 Function as on-scene commander for a Search and Rescue (SAR) operation.
- CCC 2.13 Plan, coordinate, control, and analyze the effectiveness of a Surface Mine Countermeasures/Airborne Mine Countermeasures (SMCM/AMCM) operation.
- CCC 2.15 Function as one or more of the following coordinators for force or sector.
  - (1) Air Element Coordinator (AREC)
  - (2) LAMPS Element Coordinator (LEC)
  - (4) Screen Coordinator (SC)
  - (5) Electronic Warfare Coordinator (EWC)
  - (6) Force Air Track Coordinator
  - (7) Force Surface Track Coordinator
  - (8) Force Track Coordinator
- CCC 2.16 Assist in the planning of AAW, ASU, and ASW for the coordination of air operations in the AOA.
- CCC 2.18 Function as an Anti-surface Warfare Commander (ASUWC) for force or sector.

CCC 3 Provide own unit's command and control functions.

- CCC 3.1 Maintain a CIC capable of collecting, processing, displaying, evaluating, and disseminating tactical information.
- CCC 3.3 Provide all necessary personnel services, programs, and facilities to safeguard classified material and information.
- CCC 3.4 Carry out emergency destruction of classified matter and equipment rapidly and efficiently.
- CCC 3.5 Employ Identification Friend or Foe/Selective Identification Feature (IFF/SIF) secure IFF mode 4.
- CCC 3.7 Maintain a CIC capable of supporting a TAO.
- CCC 3.8 Establish voice communications with US. Marine Corps (USMC) evacuation and command nets and Naval Support Activity (NSA) net.

CCC 4 Maintain Navy Tactical Data System (NTDS) or data link capability.

- CCC 4.2 Provide continuous Link 14 information to non-NTDS units.
- CCC 4.3 Transmit/receive and support Link 11.

CCC 4.4 Receive data link information from airborne ASW aircraft.
CCC 4.5 Receive and process data link information from Satellite Communication (SATCOM).
CCC 4.6 Receive and process data link information from High Frequency (HF) systems.
CCC 4.7 Receive Link 14 information.
CCC 4.10 Transmit/receive and correlate targeting information with Link 4A.

CCC 6 Provide communications for own unit.
CCC 6.1 Provide tactical voice communications.
CCC 6.2 Provide visual communications.
CCC 6.3 Provide multi-channel cryptographically covered teletype send and receive circuits.
CCC 6.4 Provide uncovered Radio-Teletype/Continuous Wave communications.
CCC 6.5 Provide full duplex cryptographically covered HF teletype circuits.
CCC 6.6 Process message traffic.
CCC 6.9 Maintain multi-channel crytographically covered teletype send and receive circuits (single channel for Mine Hunter Ships (MSHs)).
CCC 6.10 Provide voice/teletype/computer data cryptographically covered satellite communication circuits.
CCC 6.11 Establish and provide fixed combat communications and relay support for NSW operations.
CCC 6.12 Provide internal communications systems.
CCC 6.16 Provide tactical, secure, anti-jam Ultra-High Frequency (UHF) voice communications.
CCC 6.17 Provide tactical, secure, anti-jam Very-High Frequency (VHF) voice communications.
CCC 6.18 Provide tactical, secure, anti-jam HF voice communications.
CCC 6.19 Provide tactical, secure voice or data communications.
CCC 6.21 Provide OTCIXS.
CCC 6.22 Provide TADIXS.
CCC 6.23 Provide TADIXS B.

CCC 7 Implement Operations Security (OPSEC) measures and conduct military deception actions.
CCC 7.1 Plan, coordinate and control implementation of OPSEC measures.
CCC 7.2 Execute OPSEC measures.
CCC 7.3 Plan, coordinate and control Navy operational deception operations.
CCC 7.4 Execute Navy operational deception actions using tactics, operations, exercises or physical means.
CCC 7.6 Execute military deception actions using technical means (electronic, acoustic, visual, Electrical/Optical (E/O)).

CCC 9 Relay Naval communications with visual and electronic means.
CCC 9.1 Relay visual communications.
CCC 9.3 Relay electronic communications.

CCC 13 Provide communications support for tactical surface, submarine and air units.
CCC 13.12 Provide Harbor Common voice net support.
CCC 13.13 Provide High Command (HICOM) voice net support.
CCC 13.22 Provide Search and Rescue (SAR) communications support.

ELECTRONIC WARFARE (ELW). The effective use by friendly forces of the electromagnetic spectrum for detection and targeting while deterring, exploiting, reducing or denying its use by the enemy.

ELW 1 See Reference.
ELW 1.1 See Reference.
ELW 1.2 See Reference.
ELW 1.3 See Reference.
ELW 1.4 See Reference.
ELw 1.5 See Reference.

ELW 2 See Reference.
ELW 2.2 See Reference.
ELW 2.4 See Reference.

ELW 2.6 See Reference.
ELW 2.7 See Reference.
ELW 2.10 See Reference.

ELW 3 See Reference.
ELW 3.1 See Reference.
ELW 3.2 See Reference.

ELW 4 See Reference.
ELW 4.1 See Reference.
ELW 4.2 See Reference.
ELW 4.3 See Reference.

ELW 5 See Reference.

ELW 6 See Reference.
ELW 6.1 See Reference.

ELW 7 See Reference.
ELW 7.1 See Reference.

ELW 8 Conduct Electronic Warfare Support Measures operations in support of integrated strike training.

ELW 9 Conduct Electronic Countermeasure operations in support of integrated strike training.

ELW 10 Conduct Electronic Counter-Countermeasure operations in support of integrated strike training.

FLEET SUPPORT OPERATIONS (FSO). Naval forces and designated shore facilities providing supporting services other than logistics replenishment to fleet units.

FSO 7 Provide explosive ordnance disposal (EOD) services.
FSO 7.9 Conduct ordnance disposal and demolition operations.
FSO 7.11 Detect the presence of chemical agents.
FSO 7.21 Conduct small craft operations in support of EOD missions.

FSO 9 Provide routine health care.
FSO 9.1 Conduct daily sick call.
FSO 9.2 Conduct physical examinations.
FSO 9.4 Conduct basic ward care.
FSO 9.5 Conduct sanitation and safety inspections and provide preventive medicine instruction.
FSO 9.6 Conduct appropriate industrial hygiene/environmental health monitoring and occupational safety and health training.
FSO 9.10 Conduct on-site emergency medical treatment during hazardous evolutions including flight quarters, underway replenishment/refueling, and amphibious boat operations.
FSO 9.12 Conduct x-ray diagnostic services.

FSO 10 Provide first aid assistance.
FSO 10.1 Identify, equip, and maintain appropriate first aid spaces.
FSO 10.2 Train assigned personnel in first aid, self, and buddy procedures.
FSO 10.3 Train stretcher bearers.

FSO 11 Provide triage.
FSO 11.1 Identify, equip, and maintain suitable triage spaces.
FSO 11.2 Train assigned medical/dental personnel in triage care.
FSO 11.3 Povide for augmentation by specialized personnel and equipment.

FSO 12 Provide resuscitation.
FSO 12.1 Identify, equip, and maintain suitable resuscitation spaces.
FSO 12.2 Train assigned medical/dental personnel in resuscitation.
FSO 12.3 Povide for augmentation by specialized personnel and equipment.

FSO 13 Provide definitive care.
FSO 13.1 Provide emergency minor surgery by hospitalman.
FSO 13.2 Provide for care beds.
FSO 13.7 Provide surgery by Medical Officer (MO).
FSO 13.13 Provide care by MO trained in sick call, triage, and resuscitation.

FSO 14 Provide medical regulation of casualties.

FSO 14.2 Train medical personnel in medical regulation.
FSO 14.4 Provide for transfer/evacuation of patients.

FSO 16 Provide routine and emergency dental care.
FSO 16.1 Conduct daily sick call.
FSO 16.2 Conduct examinations (including x-ray diagnostics).
FSO 16.3 Conduct a preventive dentistry program.

FSO 17 Provide definitive dental care.
FSO 17.1 Provide restorative treatment and minor oral surgery including tooth extraction.

INTELLIGENCE (INT). The collection, processing, and evaluation of information to determine location, identification and capability of hostile forces through the employment of reconnaisance, surveillance, and other means.

INT 1 See Reference.
INT 1.1 See Reference.
INT 1.4 See Reference.
INT 1.5 See Reference.

INT 3 Conduct surveillance and reconnaissance.
INT 3.2 Conduct overt surveillance and reconnaissance operations.

INT 8 Process surveillance and reconnaissance information.

INT 9 Disseminate surveillance and reconnaissance information.

LOGISTICS (LOG). The resupply of combat consumables to combatant forces in the theater of operations.

LOG 1 Conduct underway replenishment.
LOG 1.1 Transfer ammunition underway.
LOG 1.3 Transfer cargo underway.
LOG 1.5 Transfer missiles underway.
LOG 1.15 Transfer torpedoes underway.
LOG 1.17 Transfer mines underway.

LOG 2 Transfer/receive cargo and personnel.
LOG 2.2 Provide facilities and personnel for material, mail, and passenger handling.
LOG 2.3 Act as transient personnel receiving station.
LOG 2.4 Transfer and receive personnel by helo.

LOG 3 Provide sealift for cargo and personnel.
LOG 3.1 Provide stowage and berthing spaces for equipment and personnel during transit.

MINE WARFARE (MIW). The use of mines for control/denial of sea or harbor areas, and mine countermeasures to destroy or neutralize enemy mines.

MIW 3 Conduct mine neutralization/destruction.
MIW 3.2 Destroy floating mines.
MIW 3.6 Provide support for embarked EOD/SEAL.

MIW 4 Conduct mine countermeasures (MCM).
MIW 4.2 Vector small craft to mark locataed mine like objects.

MIW 5 Support/conduct offensive/defensive service and exercise mine-laying operations.
MIW 5.1 Support/conduct service and exercise mine-laying operations by surface ships.
MIW 5.2 Support/conduct mine laying operations by aircraft in a hostile environment.

MIW 6 Conduct magnetic silencing (degaussing, deperming, etc).
MIW 6.7 Maintain magnetic signature limits.

MIW 8 Conduct precise navigation.
MIW 8.2 Navigate precisely in MCM environment.
MIW 8.3 Navigate precisely in mine laying environment.
MIW 8.5 Safely navigate minefields.

MIW 10 Provide for air operations in support of mine warfare operations.

MIW 10.1 Launch fixed wing and/or rotary wing aircraft involved in mine warfare operations.
MIW 10.2 Recover fixed wing and/or rotary wing aircraft involved in mine warfare operations.
MIW 10.5 Provide required conventional ordnance to support mine warfare operations.
MIW 10.7 Load/unload mine warfare ordnance compatible with required aircraft turnaround time.

MIW 11 Conduct Route Survey Operations.
MIW 11.3 Provide capability to collect, store, retrieve, and process MIW contact information.

MOBILITY (MOB). The ability of naval forces to move and to maintain themselves in all situations over, under or upon the surface.

MOB 1 Steam to designed capability and in most fuel efficient manner.
MOB 1.1 Steam at full power.
MOB 1.2 Steam with split plant.
MOB 1.5 Steam at sustained BG/SAG speeds.
MOB 1.6 Maintain necessary machinery redundancy to enhance survival in high threat areas.
MOB 1.7 Transit at high speed.

MOB 2 Support/provide safe, flyable aircraft for all-weather operations.

MOB 3 Prevent and control damage.
Mob 3.1 Control fire, flooding, electrical, structural, propulsion and hull casualties.
Mob 3.2 Counter and control CBR contamination/agents.
Mob 3.3 Maintain security against unfriendly acts.
Mob 3.5 Provide DC security and surveillance.
Mob 3.8 Provide emergency breathing devices per ship's allowance.

MOB 5 Maneuver in formation.

MOB 7 Perform seamanship, airmanship and navigation tasks.
MOB 7.1 Navigate under all conditions of geographic location, weather, and visibility.
MOB 7.2 Conduct precision anchoring
MOB 7.3 Get underway, moor, anchor, and sortie with duty section in a safe manner
MOB 7.5 Utilize programmed evasive steering.
MOB 7.6 Abandon/scuttle ship rapidly
MOB 7.7 Provide life boat/raft capacity IAW unit's allowance
MOB 7.8 Tow or be towed.
MOB 7.9 Operate day and night and under all weather conditions.
MOB 7.14 Moor alongside ATF shipping or docks.
MOB 7.15 Operate in a chemically contaminated environment

MOB 10 Replenish at sea.
MOB 10.1 Receive VERTREP.
MOB 10.2 Receive fuel while underway.
MOB 10.3 Receive munitions and provisions while underway.
MOB 10.4 Receive potable and/or feed water while underway.

MOB 12 Maintain the health and well-being of the crew.
MOB 12.1 Ensure all phases of food service operations are conducted consistent with approved sanitary procedures and standards.
MOB 12.2 Ensure the operation of the potable water system in a manner consistent with approved sanitary procedures and standards.
MOB 12.3 Maintain the environment to ensure the protection of personnel from overexposure to hazardous levels of radiation,
temperature, noise, vibration, and toxic substances per current instructions.
MOB 12.5 Monitor to ensure that habitability is consistent with approved habitability procedures and standards.
MOB 12.6 Ensure operation and maintenance of all phases of shipboard environmental protection systems do not create a health hazardand are consistent with other naval

directives pertaining to the prevention of pollution of the environment.

NONCOMBAT OPERATIONS (NCO). Selected operations of a noncombat nature not clearly catagorized in any other warfare mission area. Included in this catagory are the necessary support requirements and/or special missions that are required of a unit but not directly related to the other Warfare Mission Areas.

NCO 2 Provide administrative and supply support for own unit.
- NCO 2.1 Provide supply support services.
- NCO 2.2 Provide clerical Support services.
- NCO 2.3 Provide disbursing services.
- NCO 2.4 Provide post office services.
- NCO 2.5 Provide messing facilities.
- NCO 2.6 Provide ships service facilities.

NCO 3 Provide upkeep and maintenance of own unit.
- NCO 3.1 Provide organizational level maintenance.
- NCO 3.2 Repair own unit's equipment.
- NCO 3.3 Provide small arms storage area.

STRIKE WARFARE (STW). Support the destruction or neutralization of enemy targets ashore through the use of conventional weapons.

STW 8 Provide for air operations in support of air strike operations.
- STW 8.1 Launch fixed and/or rotary winged aircraft involved in air strike operations.
- STW 8.2 Recover fixed and/or rotary winged aircraft involved in air strike operations.
- STW 8.5 Provide required conventional ordnance to support strike operations.
- STW 8.7 Load/unload ordnance compatible with required aircraft turnaround times.

E. DESIGN PHILOSOPHY

Throughout the design process, specific issues and systems to be incorporated in the SPECTRE design need to be considered and trade-offs made. In order to ensure this to be a logical process, a prioritized list of the major design issues is required. This document, known as the Design Philosophy, is employed to provide consistency to all trade-offs and design decisions. This section outlines and provides justification of the issues considered important enough to be incorporated in the Design Philosophy, and their relative ranking, for the SPECTRE System. This philosophy is therefore also conveyed to the design of the CMD platform itself.

In order to develop the Design Philosophy an assessment of the many factors that steer the design of a ship is required. This list includes fundamental military and technical issues as well as those military and political issues that are currently in the spotlight, affecting design acceptance. These issues are then weighed against the mission need and the ORD to establish which are a high, medium or low priority.

1. Priority of Design Considerations

The following are those concerns that will hold the highest priority throughout the design process. Note that there is no relative ranking. These considerations are treated with equal significance and are weighted as such.

Cost

Mission Effectiveness

Mission Flexibility

The next list contains those considerations that are assigned a mid level priority. Since this list is longer than those of the highest priority and cover a wider range of concerns, a numerical ranking has been assigned to assist making trade-off decisions within this category

(1) Survivability

(2) R, M & A

(3) Affordability Through Commonality (ATC)

(4) Commercial Off The Shelf (COTS)

The remaining issues evaluated as important enough to affect the design are given the lowest priority (also ranked), as follows:

(1) Producibility

(2) Habitability (including Bi-Gender allowances)

(3) Reduced Manning

(4) Environmental

(5) Future Growth

(6) Fuel Economy

(7) Size

The final group is provided for completeness, and includes those considerations determined to be of minor concern. Some of these will manifest themselves in the design, but only to the point that they are requirements that must be included.

Appearance

Automation

Political / Societal

2. Discussion / Justification:

Mission effectiveness is an obvious priority in the design of any ship and should not require any discussion here. But the fact that mission effectiveness is given equal

weighting to *cost*, may draw significant discussion and criticism. This is a recognition of the current fiscal environment within which the Navy must operate, requiring cost effective platforms that "do more with less."

Mission flexibility is given a high priority since the CMD must operate in diverse situations with varying mission requirements, and therefore varying payloads. This directly affects the foundation of the SPECTRE concept as a tailored force, as outlined in the ORD.

Survivability is broken out of mission effectiveness and listed as a separate priority to ensure that related issues are addressed with appropriate emphasis and not lost in the tendency to treat offensive capabilities or specific systems as the only elements within mission effectiveness. Such related issues that directly affect survivability of the CMD include reduced signatures to lower susceptibility to a hit, and enclaving to reduce the CMD's vulnerability.

Reliability, Maintainability and Availability (RM&A) are considered important due to the significant impact these issues have on all the previous higher priority issues.

Affordability Through Commonality (ATC) & Commercial Off The Shelf (COTS) are listed separately as they are current programs that directly affect RM&A, platform costs and mission flexibility.

Producibility is listed as a low priority due to the potential cost savings derived from designing a ship for given production methods and ease of construction. Although listed here, designing for production cannot be allowed to have a negative effect on any of the higher priority issues.

Habitability improvements are to be considered primarily as a morale consideration, without compromising previously discussed issues.

Operational, maintenance and damage control *manning requirements* will be reduced to an optimal point in order to reduce O&S costs.

Environmental impact issues are considered so as to meet regulatory requirements, with a low priority placed on exceeding those requirements or predicting

future environmental issues.

Design considerations and margins for improving *future growth* potential are given a low priority in view of the CMD's probable size, and that a majority of the SPECTRE's combat system suite is contained in the PTX craft.

Fuel economy considerations drive the need for efficient propulsion and power generation plants in order to reduce costs and support the extended independent operating requirements of the ORD.

Optimization of *size* below the navigational requirements detailed in the ORD is given a low priority, since size inevitability has an impact on fuel consumption and platform costs.

SECTION II

COMBAT SYSTEM DEFINITION PHASE

A. PTX CAPABILITIES, EQUIPMENT AND SIZE

1. Anti-Submarine Warfare (ASW)

The ASW platform(s) must be capable of accomplishing all ASW Required Operational Capabilities (ROCs). Two possible platforms have been chosen to fullfill this mission area, One is a surface PTX craft and the other is an airborne PTX, namely the SH-60B.

A. SURFACE PTX

1. EQUIPMENT

a. Passive only towed array sonar (depths greater than 400 ft)
b. Active and passive sonobouys with tethered balloon (any depth)
c. Two twin-tube torpedo launchers (Mk 50 torpedoes)
d. Small caliber gun for close aboard small craft engagement.
e. Link 11 and link 4A data transmission/receive equipment
f. LAMPS shipboard equipment (LSE).
g. Passive Anti-Ship Missile Defense (ASMD) - CHAFF, ECM, etc.
h. UHF/HF/VHF secure and nonsecure communications.

2. SIZE/RANGE

a. Displacement: 120 tons
b. Length: 100 ft
c. Beam: 25 ft
d. Draft: 5 ft
e. Total height: 36 ft
f. Manning: 10-12 total
g. Speed: 40+ kts
h. Endurance: 8-12 hrs

B. SH-60B PTX (Seahawk LAMPS-III)

1. EQUIPMENT

a. Active and passive sonobouys (25)
b. AQS-13 dipping sonar
c. Two Mk 50 torpedoes
d. Link 11 data equipment
e. ALQ-142 ESM equipment
f. ASQ-811(V)2 MAD

2. SIZE/RANGE

a. Weight: 10 tons
b. Length: 60 ft
c. Width: 15 ft (50 ft diameter rotor)
e. Total height: 18 ft
f. Manning: 2
g. Speed: 130 kts cruise
h. Endurance: 4.5 hrs

2. Anti-Surface Warfare (ASU)

The ASU platform(s) must be capable of accomplishing all ASU and STW Required Operational Capabilities (ROCs). There are four possible platforms that fullfill this mission area, One is a surface PTX craft and the other three are airborne PTX craft, namely the AH-1W COBRA, AH-64A APACHE, and AV-8B HARRIER II. This platform is also designated as a Strike Warfare platform since the ASU weapons load-out is similar to a STW load-out.

A. SURFACE PTX

1. EQUIPMENT

a. Long range (60 nm) surface and air search/fire control radar.

b. One quad missile launcher or 2 twin tube missle launchers with long range missiles capable of engaging surface or shore targets at ranges to 80 nm using off hull targeting data.
c. 76mm gun for engagement of medium range surface and shore targets.
d. Small caliber gun for close aboard small craft engagement.
e. Passive Anti-Ship Missile Defense (ASMD) - CHAFF, ECM, etc.
f. SAT/UHF/HF secure and nonsecure communications.
g. LAMPS shipboard equipment (LSE).

2. SIZE/RANGE

a. Displacement: 130 tons
b. Length: 100 ft
c. Beam: 25 ft
d. Draft: 6 ft
e. Total height: 36 ft
f. Manning: 10-12 total
g. Speed: 40+ kts
h. Endurance: 8-12 hrs

B. AH-1W PTX (COBRA)

1. EQUIPMENT

a. Search radar
b. 20mm gun
c. Rocket pods
d. (8) TOW or (8) HELLFIRE

2. SIZE/RANGE

a. Weight: 2 tons
b. Length: 60 ft
c. Width: 15 ft (50 ft diameter rotor)
e. Total height: 18 ft

f. Manning: 2
g. Speed: 190 kts cruise
h. Range: 250 nm
h. Endurance: 2.5 hrs

C. AH-64A PTX (APACHE)

1. EQUIPMENT

a. Search radar
b. 30mm gun
c. 16 HELLFIRE or (76) 70mm rockets

2. SIZE/RANGE

a. Weight: 8 tons
b. Length: 60 ft
c. Width: 15 ft (50 ft diameter rotor)
e. Total height: 18 ft
f. Manning: 2
g. Speed: 220 kts cruise
h. Range: 300 nm
h. Endurance: 2.5 hrs

D. AV-8B PTX (HARRIER II)

1. EQUIPMENT

a. APG-65 radar
b. (2) 30mm gun
c. (14) 500lbs bombs or (6) 1000lb bombs or (4) MAVERICK air-to-surface missiles

2. SIZE/RANGE

a. Weight: 9 tons

b. Length: 45 ft
c. Width: 30 ft
e. Total height: 20 ft
f. Manning: 1
g. Speed: 615 kts cruise
h. Range: 172 nm
h. Endurance: 1.0 hrs

3. Mine Warfare (MIW)

The MIW platform(s) must be capable of accomplishing all MIW Required Operational Capabilities (ROCs). There are two possible platforms that fullfill this mission area, One is a surface PTX craft and the other is an airborne PTX craft, namely the MH-53E. The surface PTX will be capable of both mine sweeping and mine hunting. The MH-53E will be easily converted from either sweeping or hunting. An EOD or SEAL team will be carried to provide for mine identification, handling and destruction.

A. SURFACE PTX

1. EQUIPMENT

a. Double "O" sweep gear (500 yd wide path at 10 kts).
b. Mk 5(A) straight tail sweep for influence mines.
c. Mk 4(V) or Mk 6(B) acoustic noise maker sweep for influence mines.
d. AN/SQQ-32 Variable Depth Sonar (VDS) to detect and classify.
e. AN/SLQ-48 Mine Neutralization System (MNS) remotely operated vehicle or EOD detachment.
f. Passive Anti-Ship Missile Defense (ASMD) - CHAFF, ECM, etc.
g. SAT/UHF/HF secure and nonsecure communications.

2. SIZE/RANGE

a. Displacement: 130 tons
b. Length: 100 ft
c. Beam: 25 ft

d. Draft: 6 ft
e. Total height: 36 ft
f. Manning: 10-12 total
g. Speed: 40+ kts
h. Endurance: 8-12 hrs

B. MH-53E PTX (Sea Dragon)

1. EQUIPMENT

a. Mk 103 double wire sweep gear (100 yd wide path at 25 kts).
b. Mk 104 or ALQ-160 or ALQ-141 acoustic noise maker sweep for influence mines.
c. Mk 105 or ALQ-166 hydrofoil sled to sweep magnetic mines.
d. AQS-14 sonar

2. SIZE/RANGE

a. Weight: 33 tons
b. Length: 100 ft
c. Width: 25 ft (80 ft diameter rotor)
e. Total height: 25 ft
f. Manning: 3
g. Speed: 150 kts cruise
h. Range: 230 nm
h. Endurance: 4.0 hrs

4. Intelligence (INT)

The INT platform must be capable of accomplishing a large portion of the INT Required Operational Capabilities (ROCs). The only platform able to fullfill this mission area is a surface PTX craft. This PTX is smaller than the other surface PTX craft and will be utilized primary in clandestine and intelligence gathering operations. This vessel may also be configured to provide for covert incursion operations and combat Search and Rescue (SAR).

A. SURFACE PTX

1. EQUIPMENT

a. VAMPIR IR surveillance and target designator ESM system.

b. Radar and communication Direction Finding (DF).

c. Gyro stabilized weapons platform with one of the following:

1). GIAT 20mm machine gun

2). Bushwacker 25 mm gun system

3). STINGER missile system

4). JAVELIN SAM launcher

5). Portable rocket launcher

d. Night vision equipment

e. Passive Anti-Ship Missile Defense (ASMD) - RBOC and TORCH.

f. SAT/UHF/HF secure and nonsecure communications.

2. SIZE/RANGE

a. Displacement: 40 tons

b. Length: 60 ft

c. Beam: 15 ft

d. Draft: 3 ft

e. Total height: 15 ft

f. Manning: 6-8 total

g. Speed: 40+ kts

h. Endurance: 8-12 hrs

5. Anti-Air Warfare (AAW)

The AAW platform(s) must be capable of accomplishing all AAW Required Operational Capabilities (ROCs). The only feasible platform to accomplish this mission area is an airborne PTX, namely the same aircraft designated as ASU platforms but configured with AAW weapons systems. The ASU surface PTX has AAW capability built-in with the installed 76mm dual purpose gun. The AAW platforms are to provide defense against incoming aircraft

not missiles. Each PTX and the CMD must be provided with point ASMD individually.

A. AH-1W PTX (COBRA)

1. EQUIPMENT

a. Search radar
b. 20mm gun
c. (2) SIDEWINDER air-to-air missiles

2. SIZE/RANGE

a. Weight: 2 tons
b. Length: 60 ft
c. Width: 15 ft (50 ft diameter rotor)
e. Total height: 18 ft
f. Manning: 2
g. Speed: 190 kts cruise
h. Range: 250 nm
h. Endurance: 2.5 hrs

B. AH-64A PTX (APACHE)

1. EQUIPMENT

a. Search radar
b. 30mm gun
c. (2) SIDEWINDER air-to-air missiles

2. SIZE/RANGE

a. Weight: 8 tons
b. Length: 60 ft
c. Width: 15 ft (50 ft diameter rotor)
e. Total height: 18 ft

f. Manning 2

g. Speed: 220 kts cruise

h. Range: 300 nm

h. Endurance: 2.5 hrs

C. AV-8B PTX (HARRIER II)

1. EQUIPMENT

a. APG-65 radar

b. (2) 30mm gun

c. (2) SIDEWINDER air-to-air missiles

2. SIZE/RANGE

a. Weight: 9 tons

b. Length: 45 ft

c. Width: 30 ft

e. Total height: 20 ft

f. Manning: 1

g. Speed: 615 kts cruise

h. Range: 172 nm

h. Endurance: 1.0 hrs

B. CMD COMBAT SYSTEM ALTERNATIVES

The combat system alternatives were generated in order to provide a selection list from which to choose appropriate systems which support the ROCs for the CMD. The following is a compilation of the proposed combat system equipment. Each particular combat system element has numerous equipment selection possibilities to provide a specific combat capability.

1. Detection Elements

Detection elements include surface search radars, air search radars, aviation control radars, navigation equipment, electronic warfare equipment and sonar equipment.

A. Surface Search
1. SPS-63
2. SPS-64
3. SPS-67
4. SPS-55
5. LN-66
6. Radiant Mist

B. Air Search
1. 2-D
    a) SPS-49
    b) SPS-65
    c) SPS-40E
2. 3-D
    a) SPS-48E
    b) SPS-52C
    c) SPY-1B
    d) FAST
    e) FLEXAR

C. Navigation
1. WRN-6 (GPS)
2. SRN-25 (OMEGA)
3. WSN-5 (INS)

4. WQN-1 (FATHOMETER)
5. LORAN
6. SATNAV

D. Electronic Warfare

1. SLQ-32(V2)
2. SLQ-32(V3)
3. SLQ-54 (AIEWS/MATES)
4. SHIELDS V2
5. ALR-66A
6. LOCATOR 2000
7. APR-39A V2/SIEWS

E. Sonar

1. SQS-26
2. SQS-53
3. SQS-56
4. SQQ-28 (LAMPS III Data Link)
5. SQR-18 (FFG TACTAS)
6. SQR-19 (DD TACTAS)
7. SQQ-89 (SQS-53,SQR-19,SQQ-28)
8. Mine Detection / Evasion

2. Command, Control, Communication Elements

A. NTDS
B. ACDS
C. OTCIXS
D. LINK 11, 14, 16
E. TADIXS
F. CUDIXS
G. INCS
H. AEGIS Display System

3. CMD Passive Self Defense Elements

A. SLQ-25/36 NIXIE
B. MK 36 SRBOC DLS
C. SEAGNAT
D. AN/SSQ-25
E. SSTDS
F. ALEX DLS

4. CMD Engagement Elements

A. ASUW
1. 20mm BUSHMASTER
2. HARPOON
3. TOMAHAWK
4. 50 cal M2
5. 5" 54 cal
6. 76mm
7. SM-2
8. PTX

B. ASW
1. MK 32 SVTT (MK46/50 Torpedoes)
2. ASROC
3. PTX

C. AAW
1. SM-2
2. RAM
3. CIWS
4. SEA SPARROW
5. 76mm
6. 5" 54 cal
7. STINGER
8. PTX

D. STRIKE
1. TOMAHAWK

2. ATACM
3. 5" 54 cal
4. PTX

E. Mine Warfare
1. PTX

C. CMD LOAD-OUT FOR SCENARIOS

The CMD will be required to carry different mixes of PTX craft for each scenario it is engaged in. This section describes the anticipated PTX craft needed to carry out a specific mission scenario. The PTX craft are broken down into surface and airborne. The numbers of PTX craft delineated in the following section will be sufficient to control the operating area and meet all required capabilities for the given scenario. For each scenario the previously determined threats were prioritized, the PTX craft capabilities were compared and a suitable number of PTXs required was determined.

1. Support of Amphibious Landings (1 Battalion Landing Team).

Using the scenario previously stated and assuming three boat lanes for the landing, the following PTXs are required:

A. Surface PTX
1. (4) MIW
2. (4) Strike
3. (2) Surface Patrol

B. Airborne PTX
1. (4) MIW
2. (2) Strike

2. Support of Small Amphibious Landing (Personnel Evacuation, Peacekeeping, etc).

Using the scenario previously developed for semi-covert small actions the following PTXs are required:

A. Surface PTX
1. (4) Surface Patrol
2. (4) Strike (configured with AAW weapons)

B. Airborne PTX
1. (4) Strike

2. (2) MIW
3. (2) ASW

3. Conduct Harbor Blockade (Boarding, Search and Seizure, etc).

Using the scenario previously developed and assuming a harbor the size of Monterey Bay the following PTXs are required:

A. Surface PTX
  1. (6) Strike
  2. (4) Surface Patrol

B. Airborne PTX
  1. (6) Strike
  2. (2) AAW
  3. (2-4) ASW (some may be configured for MIW)

4. Conduct Area Mine Clearance.

For area mine clearance (20 sq nm) the following PTXs are required:

A. Surface PTX
  1. (8) MIW
  2. (2-4) Strike (some may be configured for AAW)

B. Airborne PTX
  1. (8) MIW
  2. (2-4) AAW
  3. (4) Strike

5. Conduct Escort Operations in Restricted Waterways.

For escort operations in previously mine sanitized waters the following PTXs are required:

A. Surface PTX

1. (6) Strike

B. Airborne PTX
1. (4) Strike
2. (4) AAW
3. (2) MIW

6. Conduct Independent PTX Operations.

For independent PTX operations the mix of PTX craft will depend entirely on the specific situation and will either be forward deployed or transported to the area and operated from a safe shore station.

7. Conduct Special Operations (INTEL, RECON, SPECOPS).

Using the scenario previously developed for covert special operations the following PTXs are required:

A. Surface PTX
1. (6) Strike
2. (6) Surface Patrol

B. Airborne PTX
1. (4) AAW
2. (4) Strike

D. CMD COMBAT SYSTEM SELECTION

A decision matrix was generated for each of the combat systems proposed in the combat system alternatives section. The matrix utilized weighted values from the design philosophy and specific combat system capabilities. The decision matrices are enclosed as appendix A.

1. Detection Elements

A. Surface Search

Based on the decision matrix the SPS-64 and SPS-67 combination was chosen for the CMD platform. Both radars are currently in use on numerous naval surface craft and thus do not require any additional research and development or operational testing. The combination of these two radars provides for excellent navigation functions and target resolution. It is envisioned that the two radar systems will be located separately on the ship. The redundancy provided by two separate radars will improve the ships survivability characteristics.

B. Air Search

The SPS-49 (2-D) air search radar was chosen based on the decision matrix and a ship visit. It was determined that a 3-D radar is not necessary for the purposes of the CMD platform. The SPS-49 provides excellent target resolution for low flying aircraft, which is the anticipated threat.

C. Aviation Control

For aviation control the SPN-35/43 combination was chosen. This radar selection provides for azimuth and elevation illumination for aircraft control and target designation. The SPN-35/43 combination can also be used for elevation information on enemy aircraft targets. TACAN was deemed necessary for the CMD mission and will be included in the combat system suite.

D. Navigation

The navigation system chosen consists of the WRN-6 Global Positioning System (GPS), SRN-25 (OMEGA), WQN-1 (fathometer), and LORAN C. This combination will provide real-time navigation capability and will be used to direct PTX craft to suspected enemy platforms. Each of these is currently being used on naval surface craft.

E. Electronic Warfare

The SLQ-32 (V3) was chosen for the CMD design. A modification to the SLQ-32 (V3) is envisioned which would include an Infrared (IR) and laser detection and jamming capability. Infrared and laser detection and jamming technology is currently available and incorporation into the SLQ-32 (V3) system seems feasible. This capability will enhance the CMD survivability characteristics and improve passive point defense.

F. Sonar

Based on projected operational scenarios, a sonar system was deemed unnecessary. A small mine avoidance sonar was proposed for inclusion but was rejected for various reasons. The PTX platforms will be required to peform underwater search and destruction.

2. Command, Control, Communication Elements

The following command, control and communication equipment was selected to provide the CMD with the capabilities required in the ROCs:

A. ACDS (Advanced Combat Direction System)

The ACDS replaces obsolescent NTDS (Navy Tactical Data System) hardware, introduces a program compatible with NTDS, but with some improvements, and features a new computer program architecture. The system is a family of computers, software packages, consoles and data links that process real-time strategic and tactical information from platforms in a task force. Information is communicated using either link 11, link 14, link 4A, or link 16. The processing system for the CMD ACDS will replace the AN/UYK-43 computers with compatible state-of-the-art COTS (Commercial Off The Shelf) computers. The data storage capability will be expandable and graphical display consoles will be compatible with emerging commercial standards.

B. LINK 11

Link 11 is a two-way real-time encrypted data link between the CMD, PTX and other ships and aircraft operating at HF or UHF bands. It is used to exchange track and tactical data, and is the primary integrating element in unified task force operations. Link

11 model five (LEMF) is the next generation which will possess greater data handling capability and increased security.

C. LINK 16

Link 16 will connect the CMD to the Joint Tactical Information Data System (JTIDS). It is designed to provide secure, jam-resistant, real-time information transfer among dispersed units which are within line of sight. This link will be the primary means of communication between the CMD, PTX and other joint forces.

D. LINK 14

Link 14 is a one-way HF or UHF data link which enables the ACDS equipped CMD to provide tactical information to non-ACDS equipped craft.

E. LINK 4A

Link 4A is a one-way UHF data link that the CMD will use to control strike platforms and interceptor aircraft.

F. CUDIXS

The Common User Digital Information System will carry two-way general service messages via satellite.

G. OTCIXS

The Officer-In-Tactical-Command Information Exchange System provides two-way secure satellite communications (voice or teletype) for the task group and for transmission of information to shore establishments.

H. IVCS

A fiber optic Interior Virtual Communication System will provide the CMD multiplexed integrated interior communications. The fiber optic cables will be redundantly routed throughout the ship to improve survivability.

I. KSQ-1

The amphibious boat control transceiver system will be used to control surface PTX craft from the CMD. The system utilizes PTX GPS locations which are satellite linked to the CMD. The CMD can then provide steering information to the PTX to vector toward a specific search area.

J. JOTS II (Joint Operational Tactical System II)

JOTS II is a battle management software system that can interface with any supporting command, control and communication system. JOTS II plots in NTDS symbology on a dynamic, high resolution color map which is used in much the same way as a paper navigation chart. The data displayed on the map can be precisely controlled by the user.

JOTS II is written in C and works within the UNIX operating system. Virtually any modern UNIX work station is compatible with JOTS II. The software consists of five main subsystems: communications, message processing, track management, tactical display, and validated applications. These subsystems form a system which can be expanded or customized for specific battle management needs. JOTS II can communicate with computers resident on ships or in shore mode with the Naval Tactical Command System through OTCIXS, the DDN, LINK 11 or LINK 14.

K. GENERAL

The CMD will maintain sufficient antennas, handsets, teletypes, switchgears, patch panels, etc. to provide for HF, UHF, VHF, SHF and satellite communications to forces afloat and ashore.

3. CMD Passive Self Defense Elements

A. SSTDS

The Surface Ship Torpedo Defense System consists of a noise making towed body, similar to SLQ-25 (NIXIE), with improved on-board signal processing.

B. ALEX

A shipboard decoy (CHAFF or IR) system made by Hycor. The 130.2 mm caliber twenty launcher system will be used on the CMD. The launchers have automatic round selection and sequencing and use current navy cartridges, as well as, Chafstar, Gemini, HIRAM and LORAC series. The ALEX system will be incorporated into the SLQ-32(V3) detection system.

4. CMD Engagement Elements

A. ASUW

For anti-surface actions the CMD will use (8) 25mm BUSHMASTER chain guns located at various stations around the ship, and (1) or (2) 76mm rapid fire automatic guns.

B. ASW

The CMD will only have passive anti-submarine weapons. Active anti-submarine actions will be performed by the ASW PTX.

C. AAW

For anti-air actions the CMD will employ (2) Rolling Airframe Missile (RAM) launchers carrying 21 rounds each and (2) Close In Weapon Systems (CIWS). The RAM is a fire-and-forget weapon, homing either on infrared or electromagnetic emissions with a range of 5nm. The CIWS fires 20mm rounds at a rate of 1000-3000 rounds per minute with an effective range of 1.5nm.

D. Strike

Strike missions will be carried out by the strike PTX.

SECTION III

PROPULSION PLANT DEFINITION PHASE

A. CMD PROPULSION PLANT ALTERNATIVES

There are numerous propulsion plant alternatives to provide the necessary power to propel the CMD at the desired speed and maintain endurance limits prescribed by the Operational Requirements Document. The most feasible alternatives are described below and are sub-catagorized into power generation, transmission and propulsor.

1. Power Generation

Power generation can be sub-divided into two broad catagories: nuclear and conventional.

A. Nuclear

Consists of the nuclear reactor, associated main machinery equipment and steam turbines.

B. Conventional

1. Steam power (S)

   Consists of boilers, steam turbines and associated auxiliary equipment.

2. Gas Turbine power (GT)

   Utilizes gas turbines as prime movers for generators and/or main engines.

3. Diesel power (D)

   Utilizes diesel engines as the prime movers for generators and/or main engines.

4. Fuel Cells (FC)

   Fuel cells generate ship's service electricity directly using the chemical reaction between gaseous hydrogen and oxygen.

2. Transmission

Power transmission is defined as the manner in which the power generated is transmitted to the propulsor which in turn drives the ship. Included in power transmission is the method by which ship's service electricity is generated.

A. Mechanical Drive (MD)

There are separate prime movers for main propulsion and ship's service electricity. The main engines are mechanically coupled to the propulsor shafts.

B. Integrated Electric Drive (IED)

The propulsion and ship's service generators are driven by the same prime mover.

C. Advanced Integrated Electric Drive (AIED)

The same concept as IED, but with advanced technology generators and motors.

D. Propulsion Derived Ship Service (PDSS)

The main engines are mechanically coupled to the propulsor shafts, and the ship's service generators are driven by the same prime mover as the main engines.

E. Power Off the Main Bus (POMS)

The propulsion motors and ships service electric distribution system recieve power from the same bus.

3. Propulsor

The propulsor is the device which imparts energy to the surrounding medium producing thrust which causes the ship to move.

A. Fixed Pitch propeller (FP)
B. Controllable/Reversible Pitch propeller (CRP)
C. Waterjet (WJ)
D. Counter-Rotating propeller (CR)
E. Vertical axis propellor (VP)

B. CMD PROPULSION PLANT SELECTION

The combat effectiveness is the prime concern in considering possible propulsion plants to incorporate into the CMD. The hull form necessary to carry out the previously discussed missions will drive the propulsion plant selection. Many alternatives were disregarded due to the high cost involved, weight and volume requirements and political considerations.

1. Power Generation

A. Nuclear Power

Nuclear power is not feasible for the SPECTRE concept due to the high cost involved in procurement, the increased weight to support reactor shielding and hull form restrictions.

B. Conventional power

Steam power (using a conventionally powered boiler to generate steam) is not feasible due to the hull form restrictions and political considerations.

Fuel cells are considered feasible but current technology does not provide for the high power requirements needed to propel the CMD.

Gas turbines and diesel engines are the primary source of power generation considered for the CMD. The low maintenance required on these systems coupled with the increased machinery arrangement alternatives provides for a durable propulsion plant.

2. Transmission

Mechanical drive, integrated electric drive and advanced integrated electric drive are all viable options for the CMD. Mechanical drive has advantages in that the technology is rather simple and the cost is low. Electric drive provides for increased machinery arrangement flexibility but is more expensive.

PDSS and POMS are considered not feasible for this design since the ships service electric power requirements will be minimal and the added cost for incorporation of these systems would not be economically feasible.

3. Propulsor

Fixed pitch propellers, controllable-reversible pitch propellers, and waterjet propulsors will be considered as possible choices in the preliminary design phase. The selection of the propulsor is closely tied to the transmission selection.

Counter-rotating propellers do not provide any added capability which affects the mission effectiveness and would increase acquisition costs.

4. Summary

To facilitate the generation of ASSET design models three different hull forms and ship sizes will be considered to provide for the needed combat capability for a given scenario. In each hull a gas turbine power plant with mechanical drive transmission and controllable-reversible pitch propellers will be considered. This provides a baseline for hull form and size selection which will be used to determine the type of platform desired for the Multi-mission Dock (CMD) platform. Propulsion plant selection and arrangements will be determined after a hull form is finalized.

SECTION IV

FEASIBILITY STUDIES

A. ASSET DESIGN MODEL ALTERNATIVES

Three ASSET design models were developed and are discussed in this section. To aid in the ship design processes a design program provided by the Decision Engineering was also used. As previously stated, all of the designs generated are conventionally powered with gas turbines, mechanically driven and have CRP propellers. Numerous assumptions were made for these models.

1. Design Model Assumptions

The unique mission of the CMD is to deliver and provide command and control of the PTXs as well as logistic support. All offensive warfare capabilities are to reside with the different PTXs while the CMD is to only have point defense capabilities. Careful consideration and evaluation of the mission of the CMD resulted in the decision that all design alternatives would have the same basic capabilities, i.e. C & C, point defense, etc. The major variation between the different design alternatives would be the number of PTXs that the CMD could carry. Evaluation of the design would be based on three different sizes of the CMD corresponding to three PTX carrying capacity options. The following is a list of the basic design assumptions used in the development of the three ASSET design models:

A. The smallest CMD was based on the smallest number of PTXs needed to form an operating unit within a particular warfare area. An example would be four mine warfare units are needed to adequately perform the mine hunting mission. The largest CMD was based on the minimum number of PTXs needed to satisfy the mission requirements of the many scenarios envisioned for the CMD. The three sizes decided upon are:

i) Small - 4 surface PTXs and 2 air PTXs.
ii) Medium - 6 surface PTXs and 6 air PTXs.
iii) Large - 8 surface PTXs and 10 air PTXs.

B. Well deck size resulted from assuming that the largest surface PTX would fit inside of a box with the dimensions of 100' x 25' x 34'. The well deck configuration would accommodate two PTXs side by side. Allowing for adequate clearance between hulls of three feet, the well deck width for all three design alternatives was set at 60'. The required length of the well deck was set according to the number of PTXs to be carried

end to end and allowing for adequate clearance between hulls. This resulted in minimum well deck lengths of 210', 315', and 420'. The forward bulkhead of the well deck was then moved forward to correspond to the standard location of a hull transverse bulkhead.

C. Hangars were sized to house approximately 50 percent of the embarked aircraft. The largest airframe to be carried by the CMD was used in determining hanger space requirements. The CH-53E was the largest airframe considered for this purpose. Square foot estimates were provided by the Decision Engineering design program. Airframe dimensions were taken from Navy pub. NWP-42.

D. Flight deck size was based on the number of launch and recover spots needed to adequately support the embarked aircraft and on the operating area required for each airframe. Three launch and recover spots were selected and labeled 1, 2, and 3. Each launch and recover spot is sized to allow simultaneous air operations by any of the embarked aircraft. Allowance was also made for equipment staging on the flight deck. Flight deck dimensions selected are 100', 305' and 410'. The width of the flight decks is designed to be at the full beam of the ship. Aircraft operating requirements were obtained from Air Capable Ship Aviation Facilities Bulletin No. 1G.

E. The hull form used was from the LSD-41 class and was modified for each of the three design alternatives considered.

F. In order to simplify the analysis, all three design alternatives were given the same propulsion design of gas turbine main engines, mechanical drive, and controllable reversible pitch propellers. Ship service generators are diesel electric generators sized to meet the required emergency electric load.

G. The deck house was sized to fill the remaining deck area from the hangar to the foc'sle. Current level of evaluation is unable to adequately determine the required area of deck house required.

H. Defensive enhancement modifications, such as angled hull and deck house to reduce radar cross section, were not employed in the ASSET modeling for the feasibility studies but were incorporated in preliminary design.

I. Weight and stability calculations were based on actual ASSET design model configurations and on modified weight statements. Weight statement data was provided from LSD-41 class full load weight statements which were scaled to the design model hull dimensions.

2. CMD Model One (CMD(S))

The first model developed is a small version of the LSD-41 class amphibious assault platform. The ASSET design model and the Decision Engineering design model characteristics are contained in appendix B. The major characteristics of this design are tabulated in table 4-1.

TABLE 4-1

Ship Displacement (full load):	16,782 long tons
Ship Volume:	2,431,533 cubic feet
Ship Length (LBP):	480 feet
Ship Length (LOA):	496 feet
Ship Beam:	88 feet
Ship Draft:	26.3 feet
Ship Range:	6000NM @ 16 kts
Ship Speed (max):	27.2 kts
Ship Speed (sustained):	26.0 kts
Main Engines:	(2) LM-2500 gas turbines
Generators:	(4) Diesel @ 1500 kW
Power Transmission:	Mechanical drive
Propulsors:	(2) CRP propellers (20 ft diameter)
Surface PTX Capacity:	(4) surface craft in well deck
Airborne PTX Capacity:	(2) MH-53E sized helos
Command and Control:	Level II (50 men)
Self Defense:	(2) CIWS, (2) RAM, small caliber guns
Average First Cost:	$ 491 million
Operating and Support Cost:	$ 25 million/year
Total Manning:	365 men (28 officer/337 enlisted)

3. CMD Model Two (CMD(M))

The medium sized CMD ASSET model characteristics are contained in appendix C. The major characteristics of this design are tabulated in table 4-2.

TABLE 4-2

Ship Displacement (full load):	19,410 long tons
Ship Volume:	3,137,190 cubic feet
Ship Length (LBP):	600 feet
Ship Length (LOA):	620 feet
Ship Beam:	90 feet
Ship Draft:	23.8 feet
Ship Range:	6000NM @ 16 kts
Ship Speed (max):	27.6 kts
Ship Speed (sustained):	26.0 kts
Main Engines:	(4) LM-2500 gas turbines
Generators:	(4) Diesel @ 2000 kW
Power Transmission:	Mechanical drive
Propulsors:	(2) CRP propellers (17.5 ft diameter)
Surface PTX Capacity:	(6) surface craft in well deck
Airborne PTX Capacity:	(6) MH-53E sized helos
Command and Control:	Level II (50 men)
Self Defense:	(2) CIWS, (2) RAM, small caliber guns
Average First Cost:	$ 560 million
Operating and Support Cost:	$ 30.5 million/year
Total Manning:	468 men (49 officer/419 enlisted)

4. CMD Model Three (CMD(L))

The ASSET design model output for the large CMD is contained in appendix D. The major characteristics of this design are tabulated in table 4-3.

TABLE 4-3

Ship Displacement (full load):	23,037 long tons
Ship Volume:	3,964,348 cubic feet
Ship Length (LBP):	720 feet
Ship Length (LOA):	745 feet
Ship Beam:	92 feet
Ship Draft:	23.7 feet
Ship Range:	6000NM @ 16 kts
Ship Speed (max):	28.0 kts
Ship Speed (sustained):	26.0 kts
Main Engines:	(4) LM-2500 gas turbines
Generators:	(4) Diesel @ 2000 kW
Power Transmission:	Mechanical drive
Propulsors:	(2) CRP propellers (17.7 ft diameter)
Surface PTX Capacity:	(8) surface craft in well deck
Airborne PTX Capacity:	(10) MH-53E sized helos
Command and Control:	Level II (50 men)
Self Defense:	(2) CIWS, (2) RAM, small caliber guns
Average First Cost:	$ 623 million
Operating and Support Cost:	$ 41.2 million/year
Total Manning:	672 men (60 officer/612 enlisted)

5. ASSET Design Comparison

Based on the projected necessary operating forces previously identified in the CMD load-out section table 4-4 was constructed. The number of CMD platforms required to perform each scenario are tabulated.

TABLE 4-4

SCENARIO	# of CMD(S)	# of CMD(M)	# of CMD(L)
Scenario #1	3	2	1
Scenario #2	3	1	1
Scenario #3	3	1	1
Scenario #4	6	2	2
Scenario #5	3	1	1
Scenario #6	N/A	N/A	N/A
Scenario #7	3	2	1

By identifying the requirements for each scenario and knowing the capabilities of each of the ASSET model CMD platforms a Measure of Effectiveness program can be used to aid in the selection of the most feasible platform.

B. MEASURE OF EFFECTIVENESS STUDIES

Some methods for measuring the effectiveness of combat systems are derived in [1]. The basic definition is:

$$\text{measure of effectiveness} = \frac{\text{fraction of mission completed}}{\text{system cost}}$$

In this analysis, the fraction of mission completed (FOMC) will be the fraction of the combat system remaining after the mission. The term 'combat system' will take on a variety of meanings. In its simplest form it will be a single weapons platform, ship or aircraft, but it will also be used to describe an entire task force.

1. Single Platform Type vs. Single Threat Type

For a single combat system engaging a single threat, the proposed measure of effectiveness (MOE) is

$$MOE = \frac{A(1-(1-DE)PL)}{C}$$

where

A = Availability of the combat system

DE = defense efficiency of the combat system against the threat

PL = loss probability of the combat system if hit by the threat

C = cost of the combat system

For multiple combat systems of the same type engaging multiple threats of the same type, the definition is extended to

$$MOE = \frac{A(1-(NT/NS)(1-DE)PL)}{NS \cdot C}$$

where

NS = number of combat system platforms

NT = number of threats

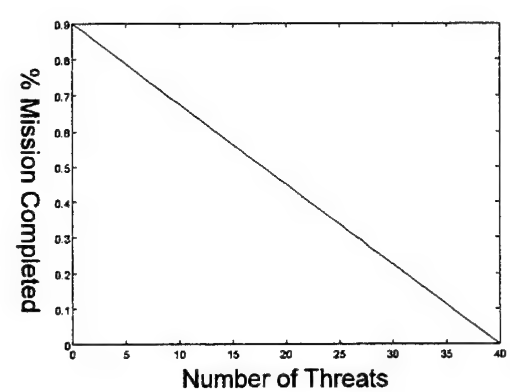
This definition includes the simplification that the threat will split evenly so that each combat system will see the same threat magnitude. At any particular instant in time this assumption is probably false. However, over the course of the entire mission, it is

likely that same type combat system platforms will be performing similar tasks. So on a time average basis, the same type combat system platforms will be exposed to an equivalent threat.

Another simplification is the use of single threat defense efficiency and loss probability parameters for multiple threats. Accurately predicting the manner in which these parameters change for different threat levels would require simulations with detailed physical models of the combat systems and threats. It is reasonable to assume that an increasing threat level will correspond to a decreasing combat system defense efficiency and an increasing loss probability. It is also likely that there is a saturation threat level above which the fraction of mission completion is zero. Using the single threat defense efficiency and loss probability parameters and the saturation threat level results in a linearly decreasing fraction of mission completion. As an example, consider a combat system with the following parameters:

Availability (A) = 0.9
Defense Efficiency (DE) = 0.9
Loss Probability (PL) = 0.25
Platform Number (NS) = 1

The fraction of mission completion is shown in the graph below. These parameters result in threat saturation level, NT = 40. Depending on the particular combat system and threat, this saturation level may or may not be reasonable. If the saturation threat level seems unreasonable, different values for defense efficiency and loss probability can be selected until the desired fraction of mission completion curve is obtained.



The next step is to develop a measure of effectiveness for a task force with multiple different combat systems engaging multiple different threats. The approach taken will be to determine an MOE for each type of combat system platform and then use a weighted average to determine the task force MOE.

2. Combined Task Force vs. Combined Threat

The MOE for the individual combat system platforms will be calculated from the following equation:

$$MOE = \frac{A}{NS \cdot C}\prod_{i=1}^{T}\left[1-(NT(i)/NS)(1-DE(i))PL(i)\right]$$

In the equation, T is defined as the number of different types of threats. If there are five different types of threats then T will be 5. Essentially, a fraction of mission completion for each threat type is calculated in the same manner as the MOE for multiple combat systems of the same type engaging multiple threats of the same type. From these calculations, the product is calculated and used in the overall combat system platform MOE calculation.

For a specific threat type, a percentage of the threat is assigned to each platform type on a value basis. This assumes that an enemy will apportion his weapons in proportion to the value of the targets. For calculations, the value of the platform is proportional to the cost of the platform. This is consistent with the assumption made for a task force composed of a single type of platform. In that situation, each platform has the same value and the threat is split equally among the platforms.

This method of calculation is an estimate in that the threats are considered individually and joint probabilities of defense efficiency and loss probability are not considered. For each different combination of threat type and number there will be a different value for defense efficiency and loss probability. As before, accurate determination of these values would require simulations with detailed physical models of the combat systems and threats. However, it is certain that with a combined threat, the total MOE will be smaller than any single threat MOE, since defense efficiency will be smaller and the loss probability larger. If for example the individual threat fraction of mission completion's are determined to be 0.9, 0.8, 0.6, 0.5, and 0.4, the product fraction of mission completion would be 0.132.

With these individual combat system MOE's, the combined task force MOE can be calculated. The assumption is that the task force fraction of mission completion is a weighted sum of the individual platforms fraction of mission completion. The assignment of weight values to the platforms needs to correspond to the importance of that particular platform in accomplishing the mission of the task force. For different scenarios, each platform would have a different weight. In order to simplify the determination of weighting factors, a reasonable assumption is that the platform's relative capability or importance in completing a particular mission is directly proportional to the platform's cost. Using this assumption the individual platform weights could be calculated as

$$W(i) = \frac{NS(i) \cdot C(i)}{\sum_{j=1}^{PT} NS(j) \cdot C(j)}$$

The numerator is the cost of all platforms of a specific type and the denominator is the cost of the task force. The parameter PT is the number of different platform type in the task force. The task force MOE can be determined from the following equation:

$$MOE = \frac{\sum_{i=1}^{PT} FOMC(i) \cdot W(i)}{\sum_{i=1}^{PT} NS(i) \cdot C(i)}$$

The numerator represents the task force fraction of mission completion and the denominator represents the task force cost.

3. Scenario Based MOE Evaluations

Earlier in the report, seven scenarios were presented. In order to evaluate the three feasible CMD designs, six of the seven scenarios will be used to develop task force MOEs. For each of the scenarios, the SPECTRE task force composition is held constant except for the number of CMDs required. The number of large, medium, or small CMDs depends upon the number of surface and air PTX platforms required in the scenario. Using this approach, the CMD carrying capability is often under utilized.

In each scenario the potential CMD threat is determined. Baseline defense efficiency and loss probability values for each CMD threat are assumed. For each of the

three feasible CMD designs, the task force MOE is calculated and the CMD with the highest MOE is selected.

To validate this selection, sensitivity analyses are performed. For each threat directed at the CMD, the threat level, defense efficiency of the CMD against the threat, and the loss probability of the CMD to the threat are varied and the task force MOE is calculated. Each parameter is varied separately while the other parameters maintain their original baseline values. The threat level is varied from zero to twice the baseline level, and the defense efficiency and loss probability are varied from 0.01 to 0.99.

The parameters are plotted against the task force MOE for each CMD. From the graphs, the CMD with the highest task force MOE is the best selection. The optimal result is for a particular CMD to produce the highest task force MOE for each parameter. This situation indicates a clear choice and validates the CMD selection based on baseline parameter values.

For the evaluations, the threat assignment probabilities and FOMC weights are directly proportional to the individual platform cost. Assumed values for defense efficiencies and loss probabilities are included in Appendix 4. The availability (A) for all platforms is assumed to be 0.90 and the platform costs (normalized) are defined below:

Platform Cost

Large CMD	0.626
Medium CMD	0.563
Small CMD	0.491
Surface Strike PTX	0.125
Surface ASW PTX	0.125
Surface MIW PTX	0.125
Surface Patrol PTX	0.040
Air Strike PTX	0.015
Air ASW PTX	0.025
Air MIW PTX	0.025
AIR AAW PTX	0.015
Aegis Combatant	1.000
LSD	0.400
LHD	0.800
Troop Carrier Surface	0.020
Troop Carrier Air	0.020

A. Scenario #1 - Support of Amphibious Landing

SPECTRE Task Force

(1) Large CMD or (2) Med. CMD or (3) Small CMD
(4) Surface Strike PTX
(4) Surface MIW PTX
(2) Surface Patrol PTX
(2) Air Strike PTX
(4) Air MIW PTX
(1) Aegis Surface Combatant
(2) LSD
(1) LHD
(14) Troop Carriers Airborne
(12) Troop Carriers Surface

Opposing Threat

(10) shore launched ASM's
(200) anti ship shore fired gun projectiles
(200) anti air shore fired gun projectiles
(10) small ship launched ASMs
(50) small ship fired anti ship gun projectiles
(10) air launched anti-air missiles
(50) mines

In this scenario, the threat potentially directed at the CMD is ship launched ASMs and ship fired projectiles. Using the baseline defense efficiency and loss probability values, the task force with the large CMD has the highest MOE. The results are tabulated in Table 4-5.

TABLE 4-5

	CMDs	Cost	DE ASM	DE Gun	PL ASM	PL Gun	TF MOE
CMD(L)	1	0.626	0.9	0.75	0.15	0.05	0.090695
CMD(M)	2	0.563	0.9	0.75	0.15	0.05	0.088529
CMD(S)	3	0.491	0.9	0.75	0.15	0.05	0.087132

The results of the sensitivity analyses are graphed in Figure 4-1. For each parameter, the large CMD produces the highest task force MOE in the range of interest. This validates the selection of the large CMD for this scenario.

A. Scenario #2 - Support of Small Amphibious Landing

SPECTRE Task Force

(1) Large CMD or (1) Med. CMD or (3) Small CMD
(4) Surface Strike PTX
(4) Surface Patrol PTX
(4) Air Strike PTX
(2) Air MIW PTX
(2) Air ASW PTX
(1) LHD
(10) Troop Carriers Airborne
(4) Troop Carriers Surface

Opposing Threat

(5) shore launched ASMs
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(5) small ship launched ASMs
(25) small ship fired anti ship gun projectiles
(5) air launched anti-air missiles
(25) mines

In this scenario, the threat potentially directed at the CMD is ship launched ASMs and ship fired projectiles. Using the baseline defense efficiency and loss probability values, the task force with the medium CMD has the highest MOE. The results are tabulated in Table 4-6.

TABLE 4-6

	Platforms	Cost	DE ASM	DE Gun	PL ASM	PL Gun	TF MOE
CMD(L)	1	0.626	0.9	0.75	0.15	0.05	0.202033
CMD(M)	1	0.563	0.9	0.75	0.15	0.05	0.205201
CMD(S)	3	0.491	0.9	0.75	0.15	0.05	0.178106

The results of the sensitivity analyses are graphed in Figure 4-2. For each parameter, the medium CMD produces the highest task force MOE in the range of interest. This validates the selection of the medium CMD for this scenario.

C. Scenario #3 - Blockade

SPECTRE Task Force

(1) Large CMD or (1) Med. CMD or (3) Small CMD
(6) Surface Strike PTX
(4) Surface Patrol PTX
(6) Air Strike PTX

(2) Air MIW PTX
(2) Air ASW PTX
(2) Air AAW PTX

Opposing Threat

(5) shore launched ASMs
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(5) small ship launched ASMs
(25) small ship fired anti ship gun projectiles
(5) air launched anti-air missiles
(25) mines
(4) submarine launched anti ship missiles
(4) submarine launched torpedoes

In this scenario, the threat potentially directed at the CMD is ship launched ASMs, ship fired projectiles, submarine launched ASMs, and submarine launched torpedoes. Using the baseline defense efficiency and loss probability values, the task force with the medium CMD has the highest MOE. The results are listed in Table 4-7.

TABLE 4-7

	CMDs	Cost	DE Ship ASM	DE Gun	DE Sub ASM	DE Sub Torpedo	PL ASM	PL Gun	PL Sub ASM	PL Sub Torpedoe	TF MOE
CMD(L)	1	0.626	0.9	0.75	0.9	0.7	0.15	0.05	0.15	0.3	0.317777
CMD(M)	1	0.563	0.9	0.75	0.9	0.7	0.15	0.05	0.15	0.3	0.332838
CMD(S)	3	0.491	0.9	0.75	0.9	0.7	0.15	0.05	0.15	0.3	0.256953

The results of the sensitivity analyses are graphed in Figures 4-3 and 4-4. For each parameter, the medium CMD produces the highest task force MOE in the range of interest. This validates the selection of the medium CMD for this scenario.

D. Scenario #4 - Mine Clearance

SPECTRE Task Force

(2) Large CMD or (2) Med. CMD or (6) Small CMD
(4) Surface Strike PTX
(8) Surface MIW PTX
(4) Air Strike PTX
(8) Air MIW PTX
(4) Air AAW PTX

Opposing Threat

(10) shore launched ASM's
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(10) air launched anti-air missiles
(10) air launched anti ship missiles
(50) mines

In this scenario, the threat potentially directed at the CMD is air launched ASMs. Using the baseline defense efficiency and loss probability values, the task force with the medium CMD has the highest MOE. The results are listed in Table 4-8.

TABLE 4-8

	Platforms	Cost	DE ASM	PL ASM	TF MOE
CMD(L)	2	0.626	0.9	0.15	0.229437
CMD(M)	2	0.563	0.9	0.15	0.237280
CMD(S)	6	0.491	0.9	0.15	0.162822

The results of the sensitivity analyses are graphed in Figure 4-5. For each parameter, the medium CMD produces the highest task force MOE in the range of interest. This validates the selection of the medium CMD for this scenario.

E. Scenario #5 - Escort Operations

SPECTRE Task Force

(1) Large CMD or (1) Med. CMD or (3) Small CMD
(6) Surface Strike PTX
(4) Air Strike PTX
(2) Air MIW PTX
(4) Air AAW PTX
(1) Aegis Surface Combatant

Opposing Threat

(5) shore launched ASMs
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(5) small ship launched ASMs
(25) small ship fired anti ship gun projectiles

(5) air launched anti-air missiles
(10) mines

In this scenario, the threat potentially directed at the CMD is ship launched ASMs and ship fired projectiles. Using the baseline defense efficiency and loss probability values, the task force with the medium CMD has the highest MOE. The results are listed in Table 4-9.

TABLE 4-9

	Platforms	Cost	DE ASM	DE Gun	PL ASM	PL Gun	TF MOE
CMD(L)	1	0.626	0.9	0.75	0.15	0.05	0.206057
CMD(M)	1	0.563	0.9	0.75	0.15	0.05	0.209211
CMD(S)	3	0.491	0.9	0.75	0.15	0.05	0.182153

The results of the sensitivity analyses are graphed in Figure 4-6. For each parameter, the medium CMD produces the highest task force MOE in the range of interest. This validates the selection of the medium CMD for this scenario.

F. Scenario #6 - Special Operations

SPECTRE Task Force

(1) Large CMD or (2) Med. CMD or (3) Small CMD
(6) Surface Strike PTX
(6) Surface Patrol PTX
(4) Air Strike PTX
(4) Air AAW PTX

Opposing Threat

(10) shore launched ASMs
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(10) air launched anti-air missiles
(10) air launched anti ship missiles

In this scenario, the threat potentially directed at the CMD is ship launched ASMs. Using the baseline defense efficiency and loss probability values, the task force with the large CMD has the highest MOE. The results are listed in Table 4-10.

TABLE 4-10

	Platforms	Cost	DE ASM	PL ASM	TF MOE
CMD(L)	1	0.626	0.9	0.15	0.405889
CMD(M)	2	0.563	0.9	0.15	0.334245
CMD(S)	3	0.491	0.9	0.15	0.298209

The results of the sensitivity analyses are graphed in Figure 4-7. For each parameter, the large CMD produces the highest task force MOE in the range of interest. This validates the selection of the large CMD for this scenario.

G. Conclusions

Using the baseline parmeters, the medium CMD yields the highest task force measure of effectiveness in four of the six scenarios. The sensitivity graphs show that in three of these four scenarios, the large CMD can produce a task force MOE equivalent to the medium CMD with baseline parameters, if the large CMD's defense efficiency and loss probability are changed toward ideal values. However, the realization of these near ideal parameters would probably result in higher cost, mitigating the perceived increase in task force MOE. Also, any design change in the large CMD that would push defense efficiency and loss probability toward ideal values would be valid to some degree for the medium CMD.

The task force MOEs with the small CMD could not equal the task force MOEs with the large or medium CMD, even as defense efficiency and loss probability approached ideal values.

Figure 4-1. Scenario 1 Sensitivity Graphs. CMD(L) — CMD(M) ··· CMD(S) —·—·

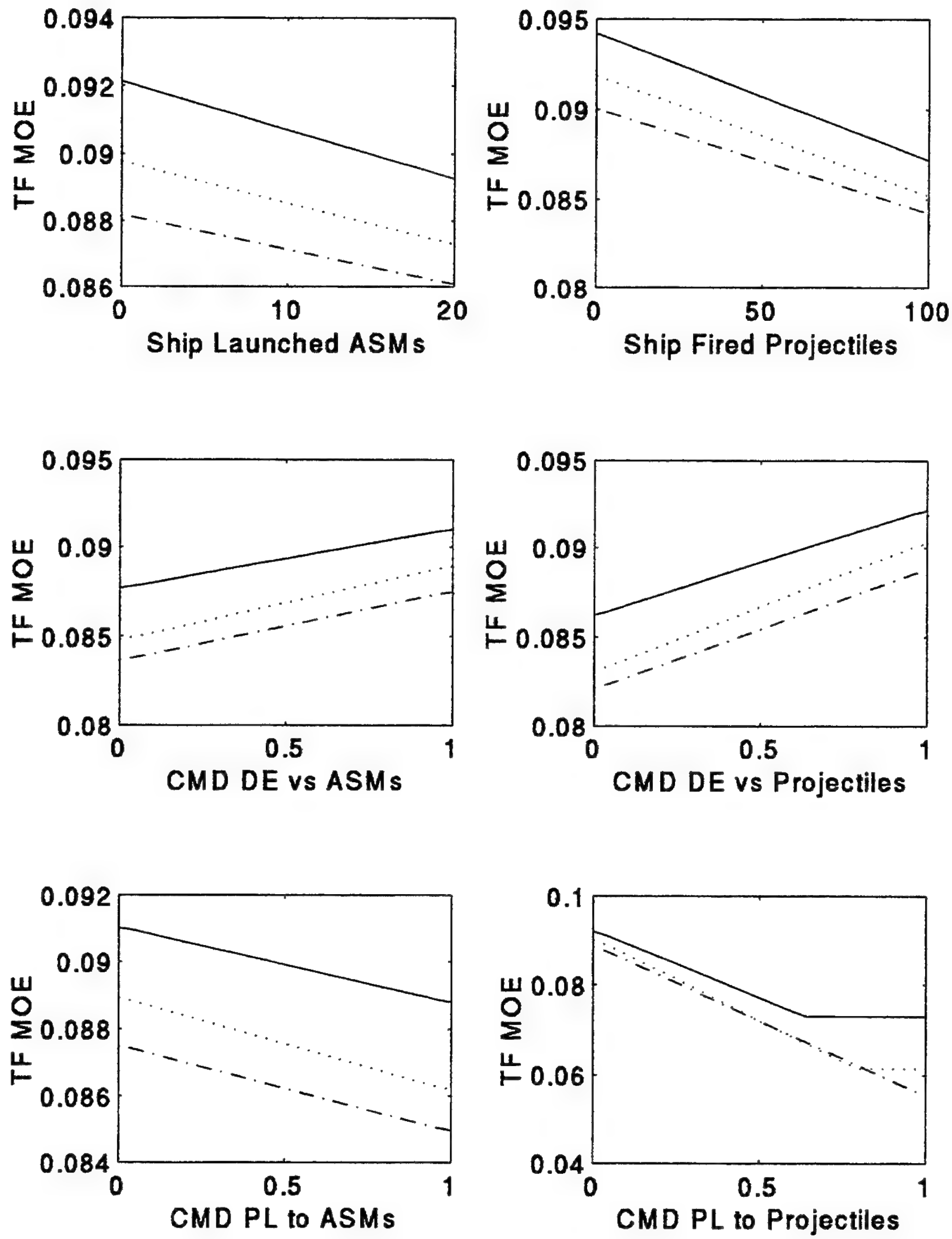


Figure 4-2. Scenario 2 Sensitivity Graphs. CMD(L) — CMD(M) ··· CMD(S) —·—·

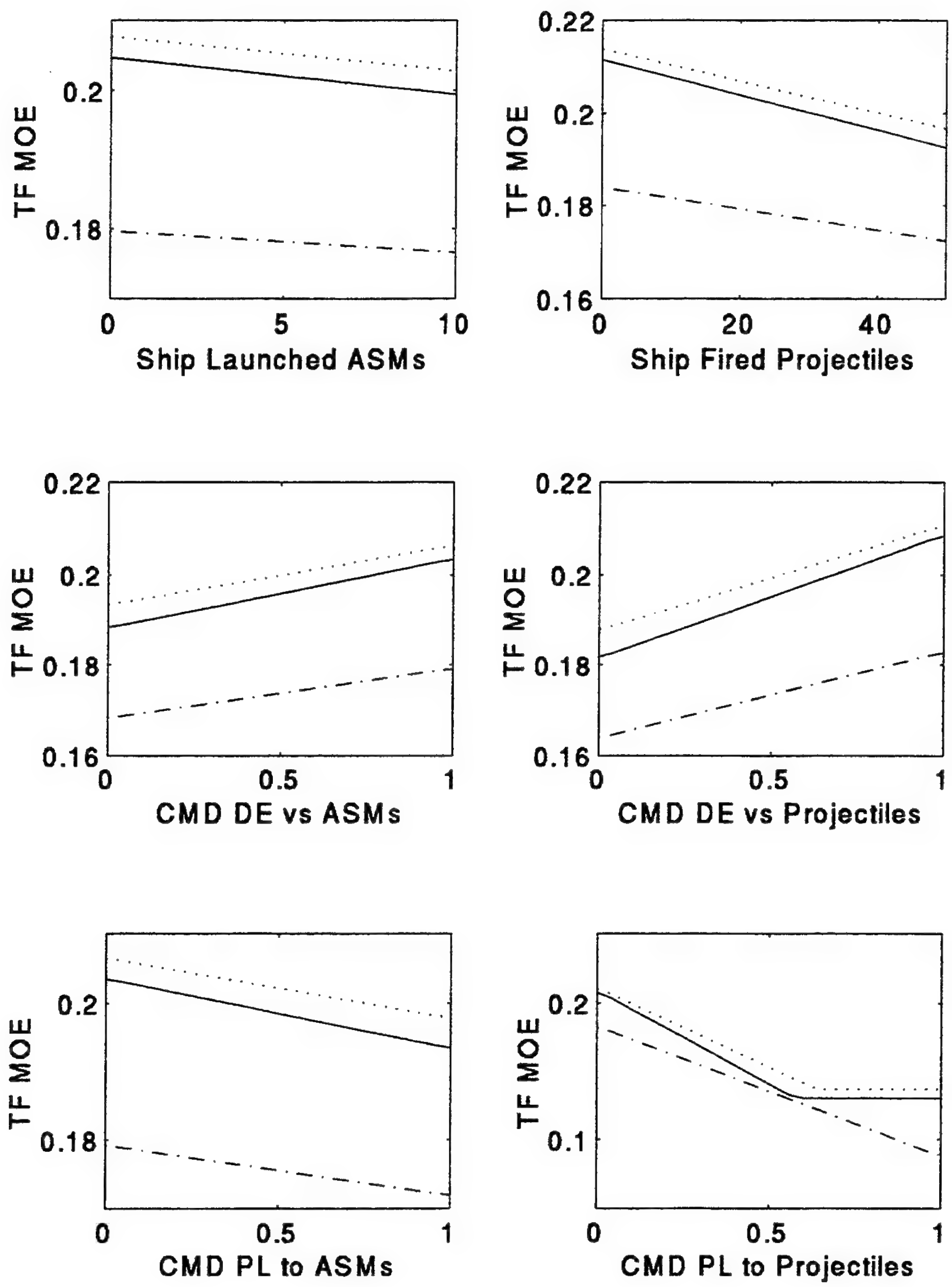


Figure 4-3. Scenario 3 Sensitivity Graphs. CMD(L) — CMD(M) ··· CMD(S) —·—·

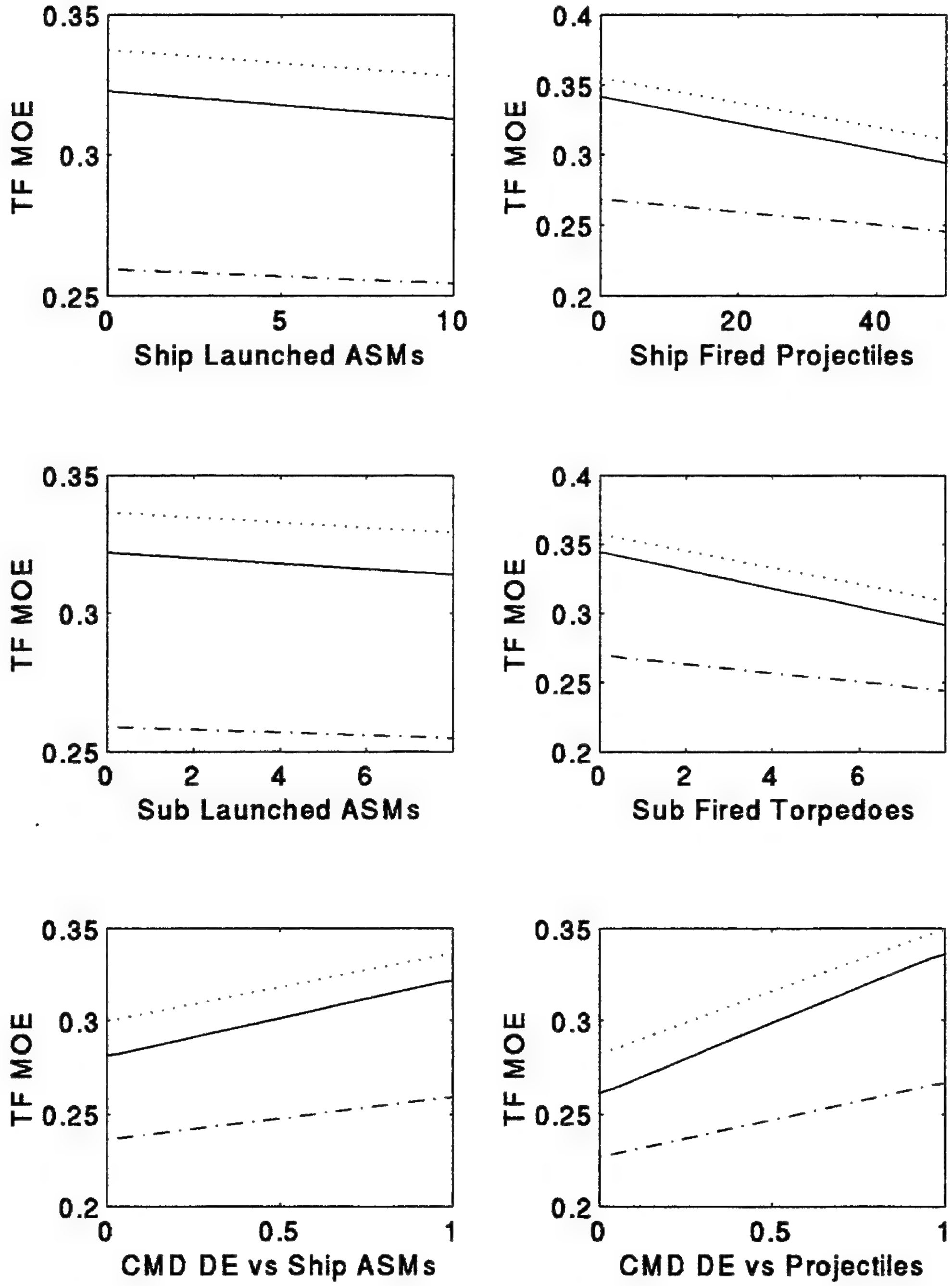


Figure 4-4. Scenario 3 Sensitivity Graphs. CMD(L) — CMD(M) ··· CMD(S) —·—·

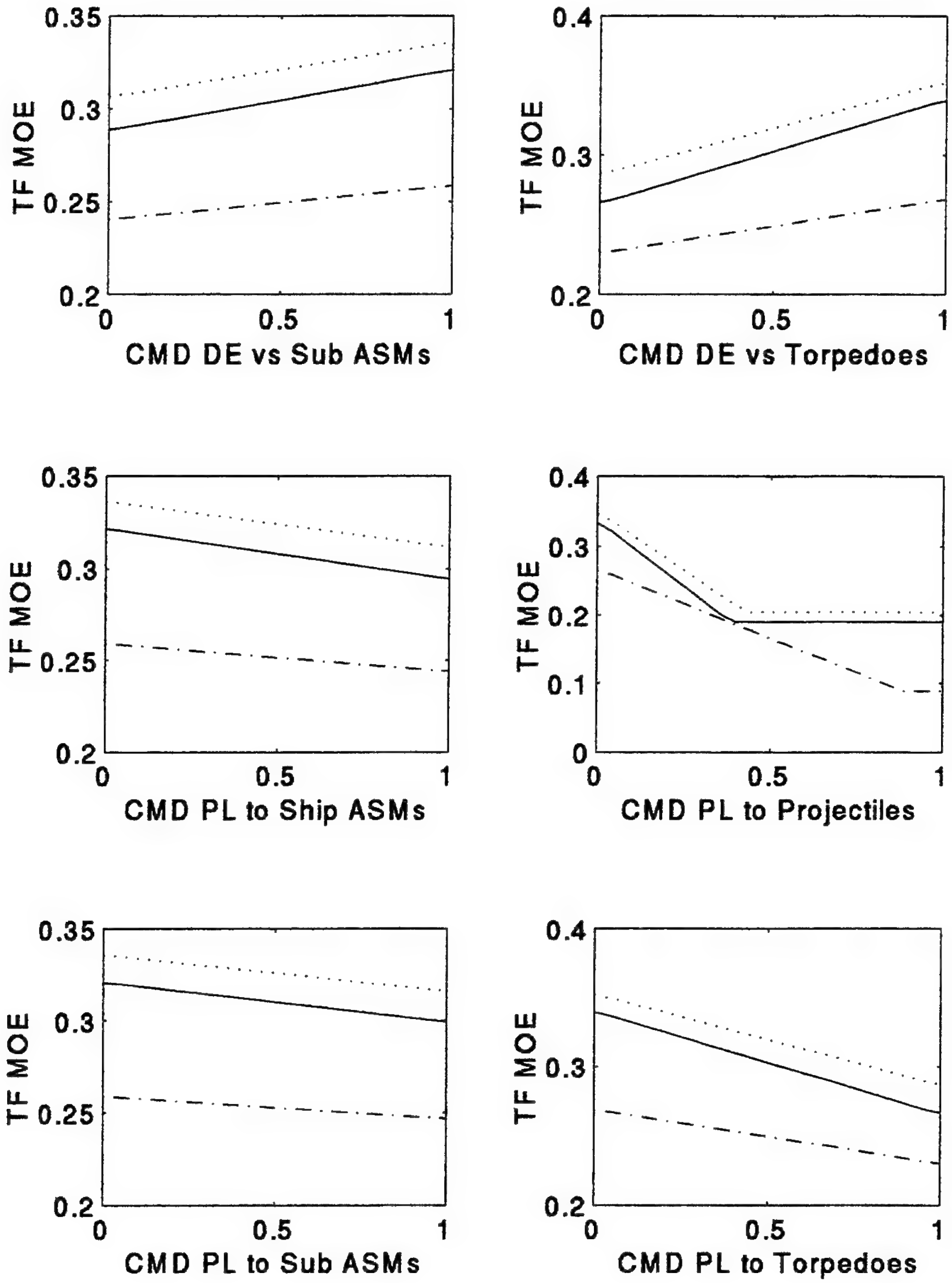
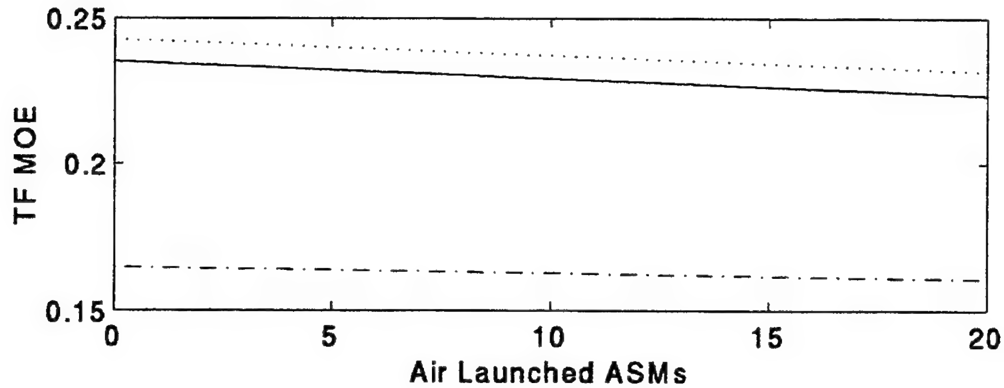
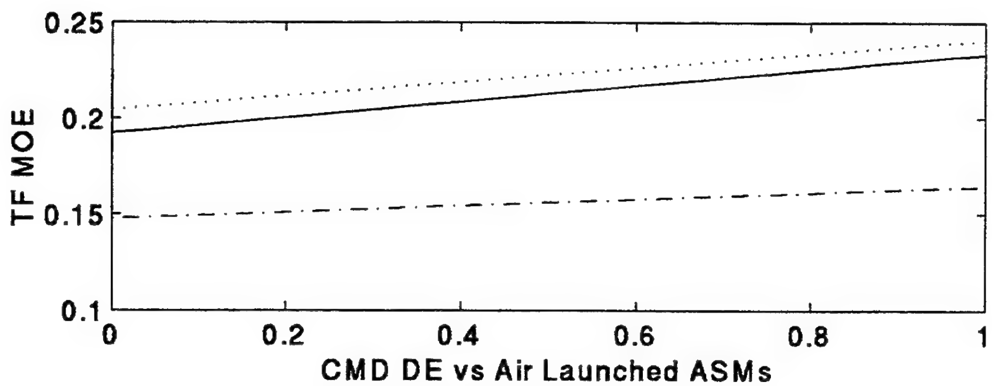


Figure 4-5. Scenario 4 Sensitivity Graphs. CMD(L) — CMD(M) ··· CMD(S) —·—·





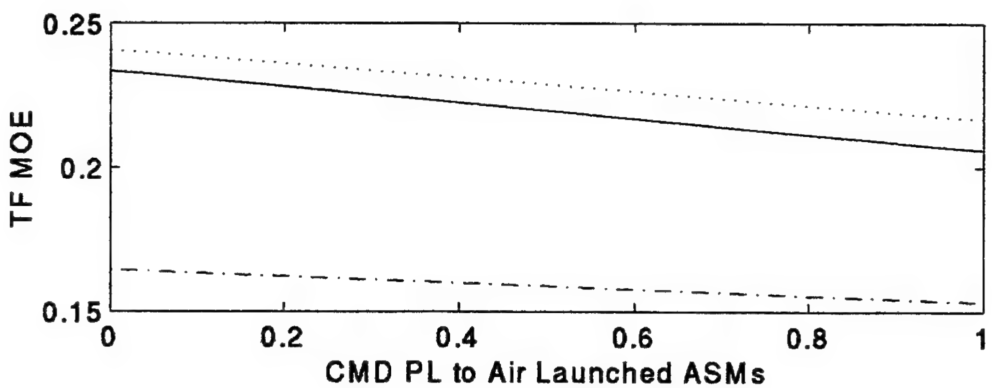


Figure 4-6. Scenario 5 Sensitivity Graphs. CMD(L) — CMD(M) ··· CMD(S) —·—·

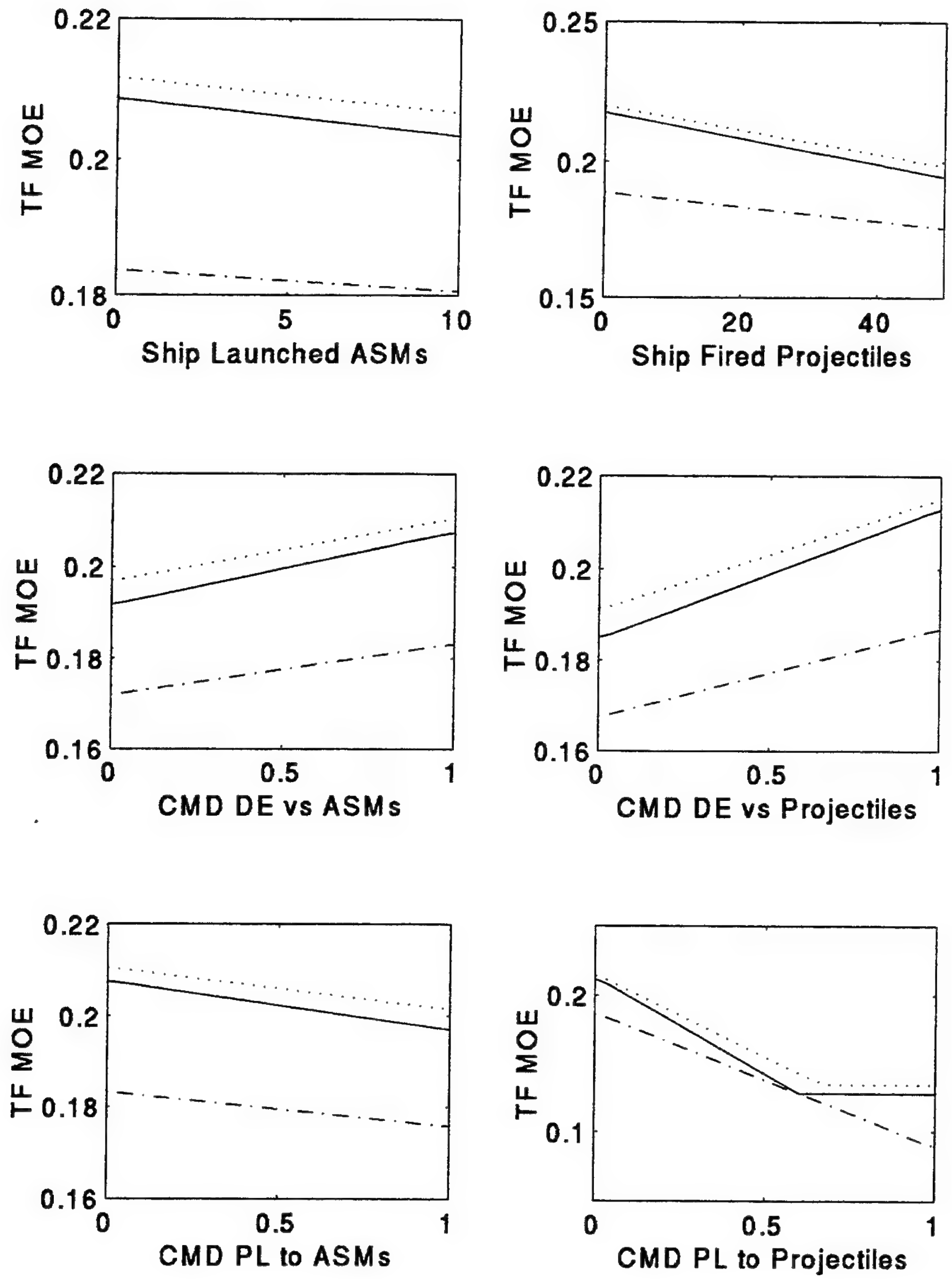
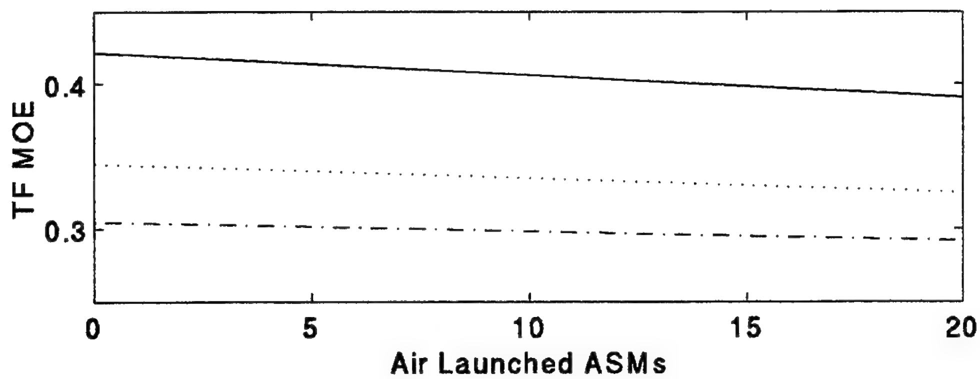
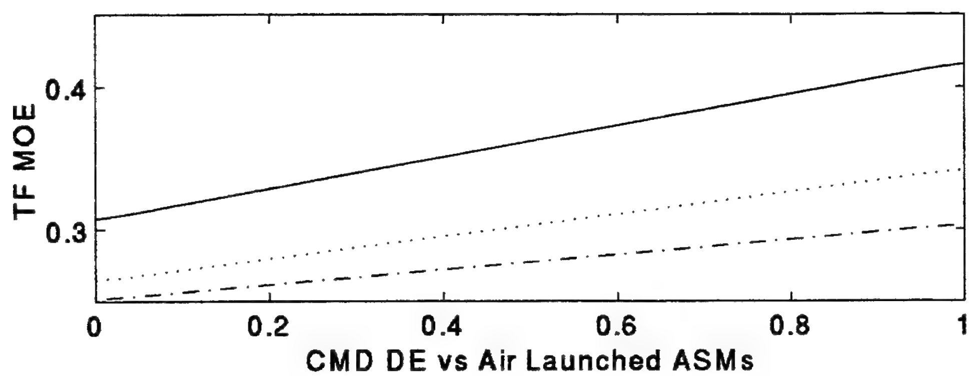
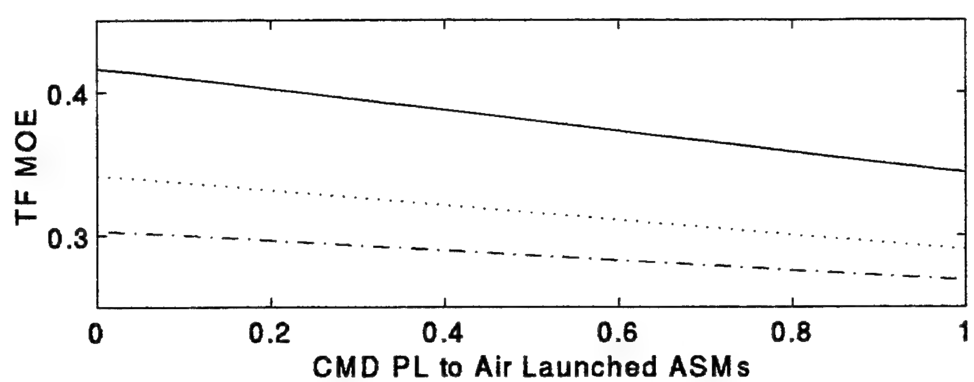


Figure 4-7. Scenario 6 Sensitivity Graphs. CMD(L) — CMD(M) ··· CMD(S) —·—·







C. CMD DESIGN SELECTION

Using the ASSET design model alternatives and the Measure of Effectiveness studies (MOEs) the medium sized CMD was chosen. The justification for this selection is based on the design philosophy, MOEs, and anticipated scenario environments.

1. Major Characteristics Review

The major CMD(M) ship characteristics are specified in table 4-2. The following information is provided to amplify these characteristics and to serve as a comparison with current Navy assets.

A. DISPLACEMENT

The displacement of the CMD(M) is slightly greater than the current LSD-41 class Dock Landing Ship and less than half that of the LHD-1 class Helicopter Dock Landing Ship.

B. DRAFT

The draft of the CMD(M) is comparable to the LSD-41 class and less than the LHD-1 class.

C. MANNING

The total manning requirements for the CMD(M) are comparable to the LSD-41 class and slightly higher than the CG-47 class Cruiser. The CMD(M) is not designated as a troop carrier.

D. ENDURANCE

The endurance of the CMD(M) is within prescribed limits as designated in the ORD. This endurance is comparable to both the CG-47 class Cruiser and the LSD-41 class Dock Landing Ship.

2. Design Selection Justification

To justify the selection of the CMD(M) the top priority design philosophy requirements must be compared.

A. COST

The cost of the CMD(M) is within prescribed limits as set in the ORD. The CMD(L), at $623 million, exceeded the $600 million limit. The smaller crew size on the CMD(M) will provide for a lower life cycle cost than that of the CMD(L).

B. MISSION EFFECTIVENESS

The Measure of Effectiveness (MOE) models generated in the previous section compare ship cost to combat effectiveness. The MOEs determined that the CMD(M) had a greater "bang for the buck" than the other two platforms in most of the scenarios.

C. MISSION FLEXIBILITY

Mission flexibility is inherent in the SPECTRE design concept, however due to its size the CMD(L) can be configured to handle a more diverse tactical atmosphere. Since the CMD(M) is smaller, one CMD platform can be configured for one type of scenario while another can be configured for a completely different scenario. Each platform has desireable characteristics but the medium sized CMD is more cost effective.

D. GENERAL

The CMD(M) leads all three selections in MOEs, has a smaller crew than the CMD(L), and results in less detrimental loss in the case of loss of the ship than the CMD(L).

The CMD(S) does not have sufficient capability to make it a viable platform. The number of small CMDs required in most of the scenarios cause the economic unfeasibility of the CMD(S).

The overall ship characteristics of the CMD(M) provide for the use of other design philosophy considerations such as survivability, producibility, fuel economy and the possibility of future growth.

3. Preliminary Design Specification

The preliminary design process will begin with the ASSET design model chosen. The propulsion plant type, propulsion arrangements, combat system integration and top-

side arrangements are some of the topics which will be addressed in the preliminary design process.

The overall ship characteristics generated in the ASSET design model will remain intact throughout the prelimnary design phase. Some adjustments in ship defense efficiency may be required to improve the combat effectiveness of the CMD platform chosen and ship size will be altered to compensate for varying aspects of the ship design.

SECTION V

PRELIMINARY DESIGN

A. CMD FINAL PROPULSION PLANT SELECTION

Four types of propulsion plants were considered for the CMD. The ASSET design model was used to generate pertinent data for each type and the design program outputs are enclosed as appendix F. Table 5-1 is a tabulated list of the main ship characteristics generated by each type of propulsion plant. The engine powers are provided in kilowatts to provide unit continuity.

Table 5-1

	LM-2500 ELECT DRIVE FP PROP	LM-2500 MECH DRIVE CRP PROP	PC2 DIESEL MECH DRIVE CRP PROP	LM-2500 ELECT DRIVE PODS
SHIP LENGTH (LBP)	630 FT	630 FT	630 FT	630 FT
FULL LOAD SHIP DISPLACEMENT	20,680 LT	21,375 LT	19,690 LT	20,680 LT
NUMBER OF ENGINES	4 GAS TURBINE @ 19,600 KW (EA)	4 GAS TURBINE @ 19,600 KW (EA)	4 PC2/18 DIESEL @ 8,725 KW (EA)	4 GAS TURBINE @ 19,600 KW (EA)
NUMBER OF GENERATORS	2 MTU-16V538 @ 2000 KW (EA)	4 MTU-16V538 @ 2000 KW (EA)	4 MTU-16V538 @ 2000 KW (EA)	2 MTU-16V538 @ 2000 KW (EA)
MAX SPEED	29.75 KTS	30.2 KTS	25.35 KTS	27.31 KTS
PROP DIAMETER	19.2 FT	17.6 FT	15.0 FT	19.3 FT
SHAFT LENGTH (PORT)	148.7 FT	246.3 FT	252.6 FT	4.8 FT
SHAFT LENGTH (STBD)	148.7 FT	340.7 FT	387.6 FT	4.8 FT
PROP PLANT WEIGHT	1024.7 LT	1037.5 LT	1081.6 LT	914.9 LT
PROP PLANT VOLUME	176,026 CU FT	144,381 CU FT	179,967 CU FT	152,946 CU FT
FULL POWER SFC	0.393 LBM/HP-HR	0.393 LBM/HP-HR	0.340 LBM/HP-HR	0.393 LBM/HP-HR
CRUISE SFC	0.521 LBM/HP-HR	0.628 LBM/HP-HR	0.333 LBM/HP-HR	0.456 LBM/HP-HR
MANNING	468 TOTAL	468 TOTAL	468 TOTAL	468 TOTAL

1. Propulsion Plant Selection

Based on the detailed listings of propulsion plant and ship characteristics in appendix F and using the design philosophy the LM-2500, Advanced Integrated Electric Drive (AIED) with fixed pitch propeller was chosen. The four large gas turbine engines coupled with the two small diesel engines will be used in a power off the main bus configuration. This system will provide for added flexibility in propulsion plant alignment leading to reduced ship response times and improved fuel efficiency at low operating speeds.

2. Selection Justification

A. DIESEL/MECHANICAL DRIVE

The diesel/mechanical drive combination does not support the required max speed as delineated in the ORD. This type of arrangement, therefore, reduces the mission effectiveness and mission flexibility of the SPECTRE system. A diesel/AIED was not considered in the ASSET models for two reasons. (1) The AIED output would have had similar results in maximum speed. (2) An increase of approximately three PC2/18 diesel engines would have to be incorporated in the model to achieve the desired maximum speed. This would lead to an overall propulsion plant weight and volume increase. The new weight would be approximately twice and volume would be approximately three times that of the gas turbine plants. The additional engines would increase the maintenance requirements for shipboard and shore facilities personnel.

B. GAS TURBINE/AIED/PODS

The gas turbine POD design has appealing attributes in that the weight and volume of the propulsion plant are low, the maximum speed is good, and the Specific Fuel Consumptions (SFC's) are low. The POD propulsor however, has not been proven in past ship designs. The location of the POD motors would require special tools and may require the ship to be dry docked to conduct repairs.

C. GAS TURBINE/MECHANICAL DRIVE

The main disadvantages of the Gas Turbine/mechanical drive propulsion plant are the long lengths of shafting and the high SFC's. The LONG shafting length leads to reduced survivability since more critical volume of the ship is vulnerable to a weapon detonation. The use of Controllable/Reversible Pitch (CRP) propellers also adds to the complexity of the propulsion system.

D. GAS TURBINE/AIED

The Gas Turbine/AIED propulsion plant offers a very good mix of system performance and system characteristics. The plant is light weight, medium volume, and has much shorter shaft lengths than the mechanical drive system. The AIED plant uses Fixed Pitch (FP) propellers which are much less complex than CRP propellers. The incorporation of power off the main bus allows for a flexible plant configuration which improves mission flexibility, mission effectiveness, survivability and plant efficiency.

The use of LM-2500 gas turbines will lead to improved R,M&A characteristics since the LM-2500 engines have been proven to operate well in all environmental conditions. Maintenance and installation costs should be lower than the previously mentioned propulsion plants.

B. GENERAL COMBAT SYSTEMS ARCHITECTURE

The combat system elements were defined in section 2. To provide a more detailed architecture for the combat system, readiness logic diagrams, mission area architecture diagrams and Funtional Flow Description Diagrams (F^2D^2) were generated. The purpose of these diagrams is to aid in the combat system equipment and space arrangements.

1. Readiness Logic Diagrams

The readiness logic diagrams provide combat readiness information for the entire SPECTRE system. The diagrams for each warfare area are specified in figures 5-1 through 5-6. The readiness rating levels utilized are established in NWP 10-1-11 , Status of Resources and Training System (SORTS). A brief summary of these rating levels is provided in table 5-2.

TABLE 5-2

RATING LEVEL	DESCRIPTION OF CAPABILITY
M1	90 to 100 percent
M2	70 to 89 percent
M3	60 to 69 percent
M4	1 to 59 percent
M5	No Capability

The S and P designations on the readiness logic diagrams denote parallel and/or series combinations respectively. The actual values of the individual ratings may vary depending on ship survivability characteristics. The readiness of the PTXs has great influence on the overall readiness of the SPECTRE sytstem.

2. Architecture Diagrams

The mission area architecture diagrams for the CMD only are depicted in figures 5-7 through 5-12. The functional relationship between operating systems is shown along with the inter-connectablity of each individual combat system. Detection and tracking capability is not included in the intelligence (INT) mission area since most intelligence data will be received from outside sources.

All mission areas rely on onboard computer systems for information correlation, command and decision and weapons control actions. Computer centers and command and control stations will be located in separate zones within the CMD to provide for redundancy and improved survivability.

3. Functional Flow Diagrams

The Functional Flow Description Diagrams are provided for Tier 0 in figure 5-13 and Tier 1 in figures 5-13a through 5-13k. These diagrams provide guidance to ensure equipment is configured and arranged to provide for maximum effectiveness and to aid in the combat system arrangements.

Each block in Tier 0 is expanded in the Tier 1 diagram. It is imperative for the SPECTRE system that readiness information is available to the CMD from the PTX platforms. This will provide for acurate target designation and weapons assignment. The CMD will use PTXs to engage targets as well as its own installed weapons.

4. Support Services

The combat system on the CMD will require both AC and DC electric power, cooling water, air conditioning and various other support services.

The combat system will be connected with fiber optic data buses wherever feasible to decrease data transmission cable weight and provide for increased volume of data transfer.

Figure 5-1. SPECTRE AAW Readiness Logic Diagram

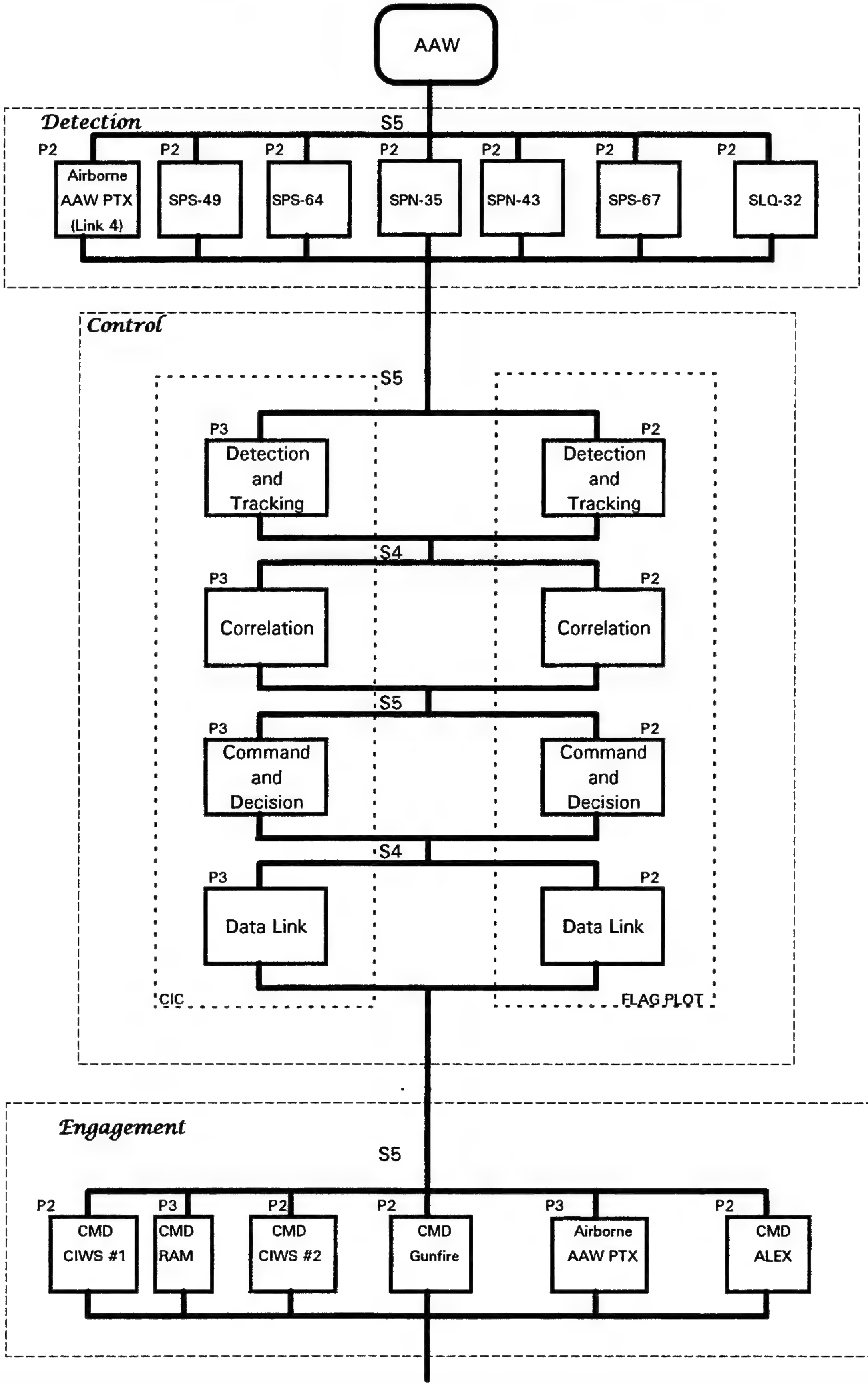


Figure 5-2. SPECTRE ASU Readiness Logic Diagram

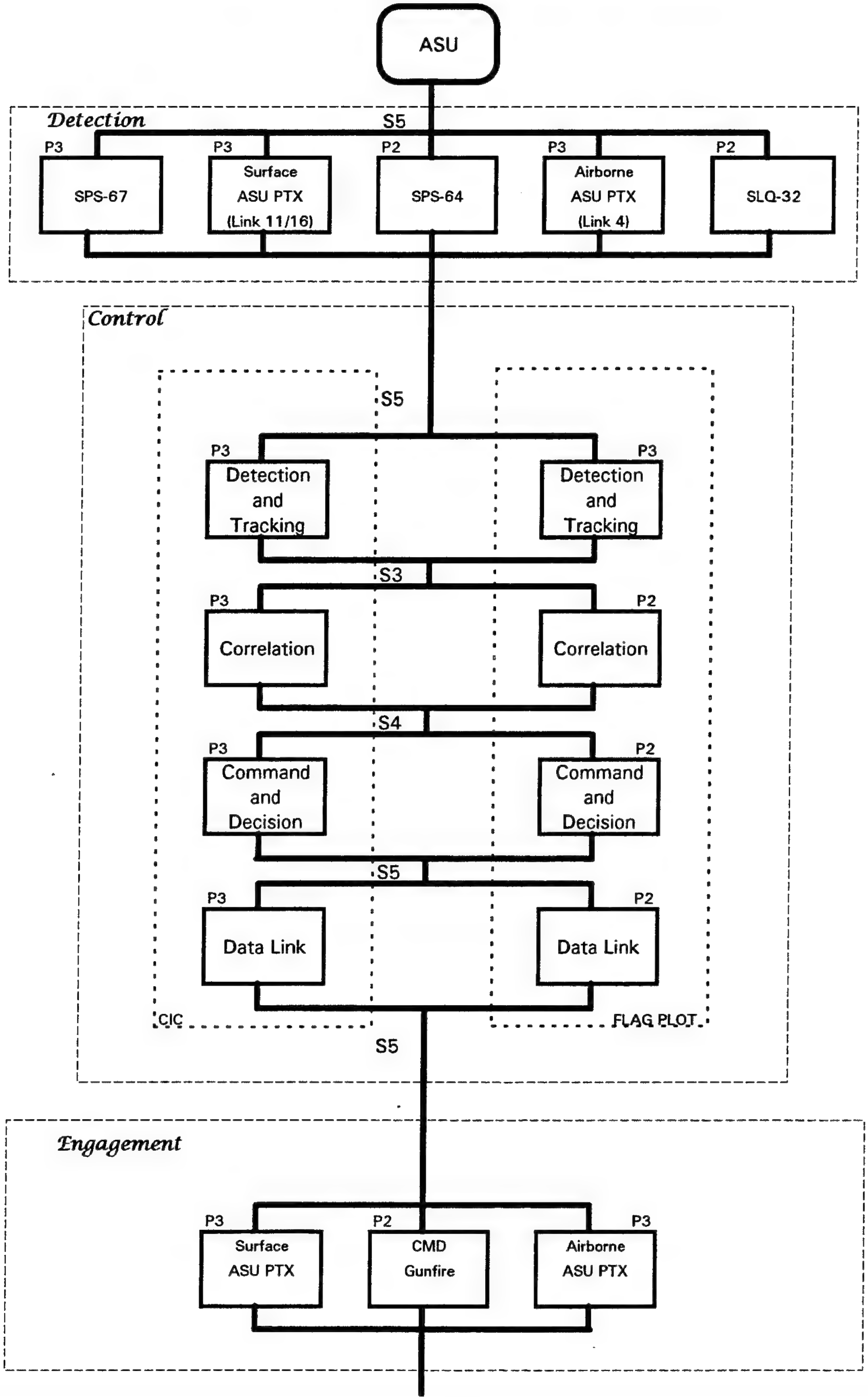


Figure 5-3. SPECTRE ASW Readiness Logic Diagram

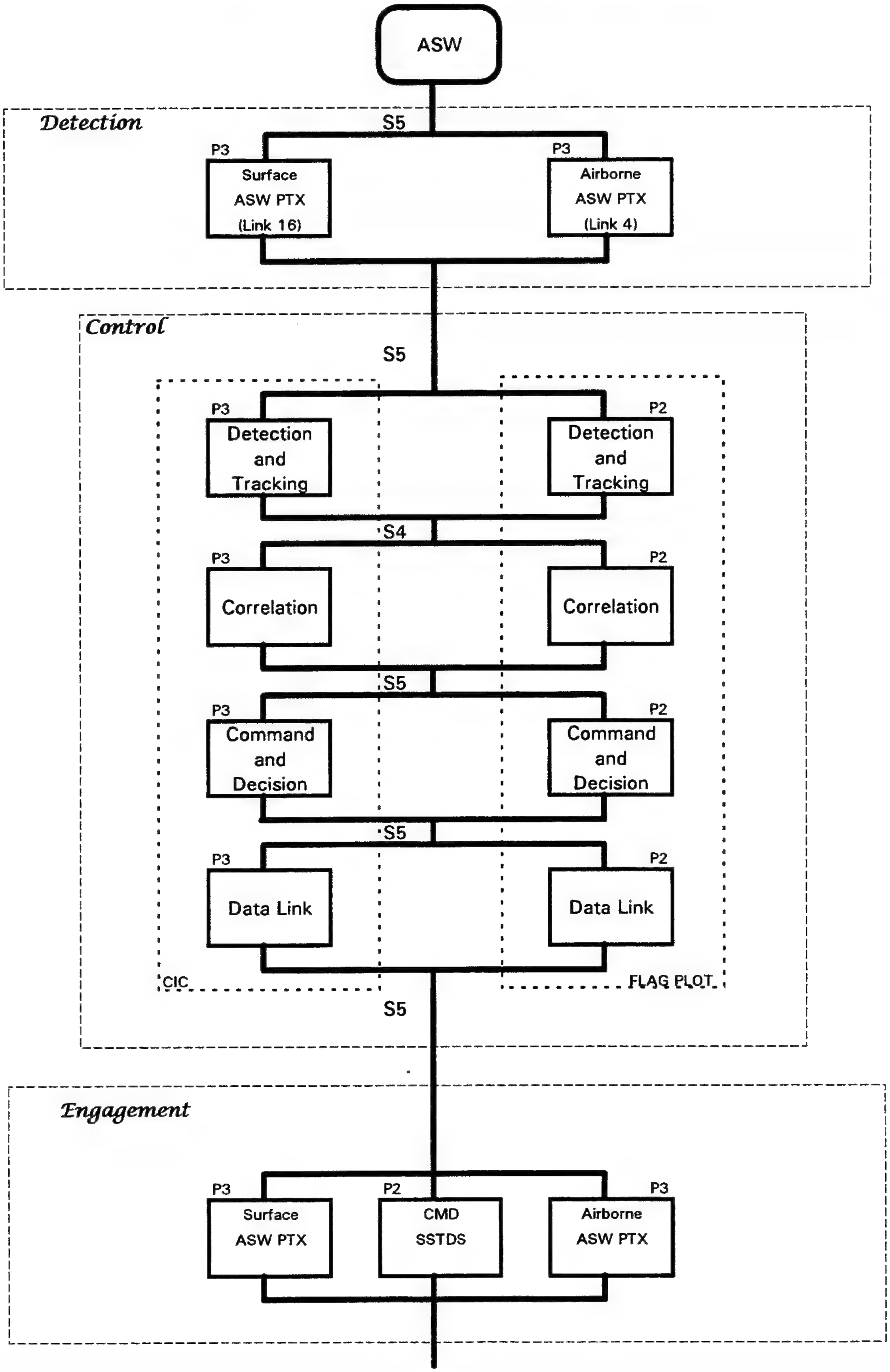


Figure 5-4. SPECTRE INT Readiness Logic Diagram

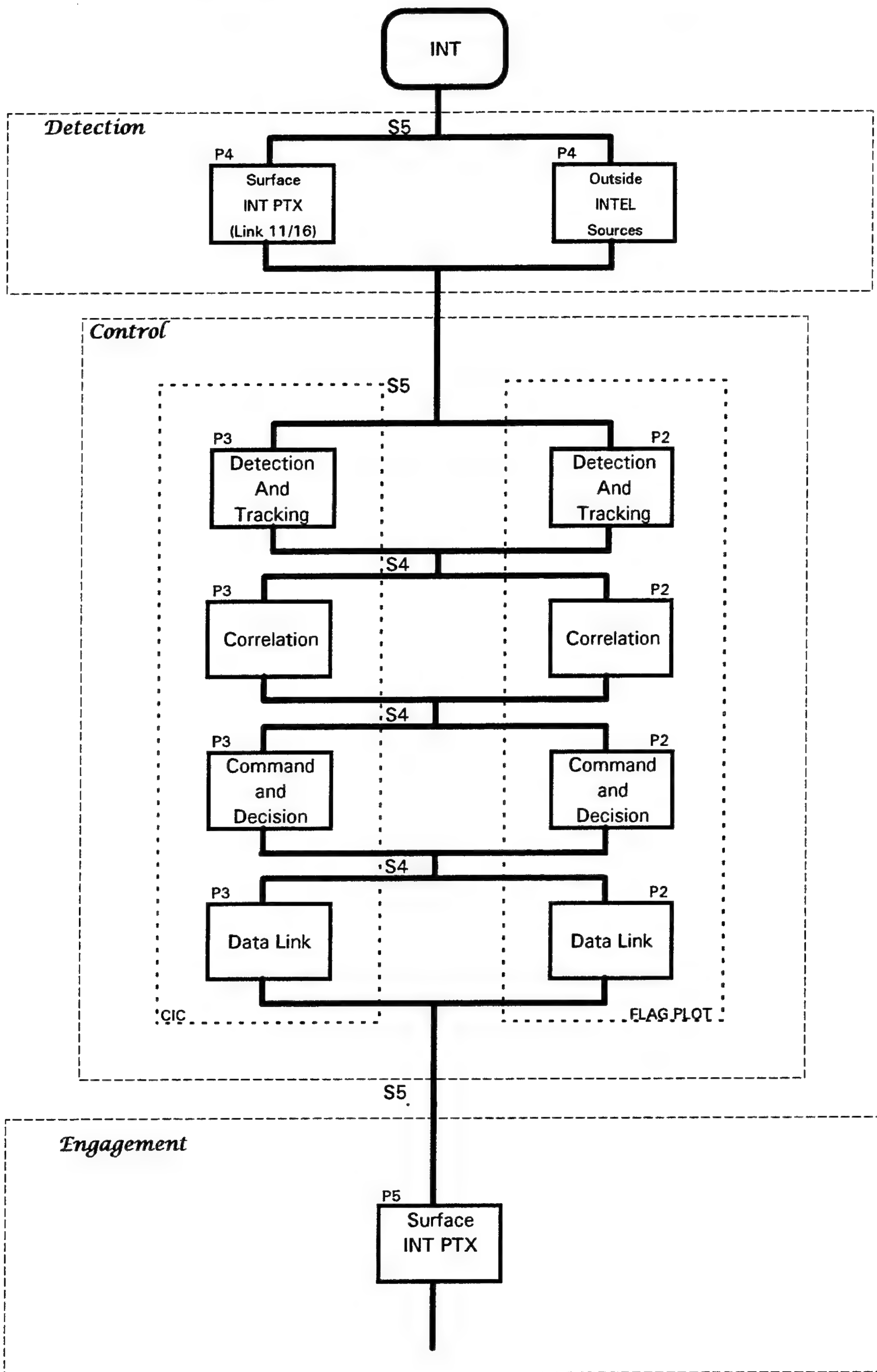


Figure 5-5. SPECTRE MIW Readiness Logic Diagram

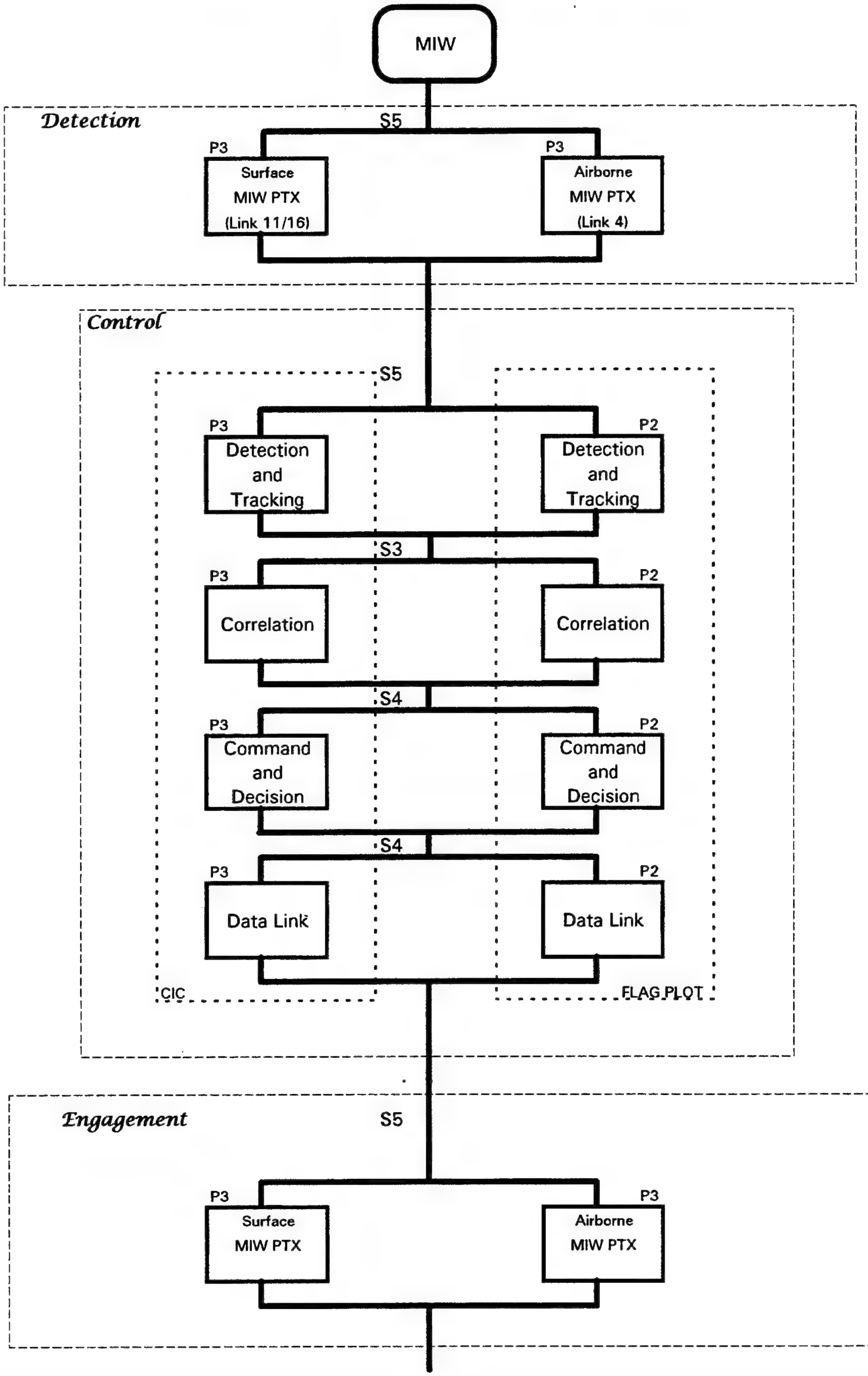


Figure 5-6. SPECTRE STW Readiness Logic Diagram

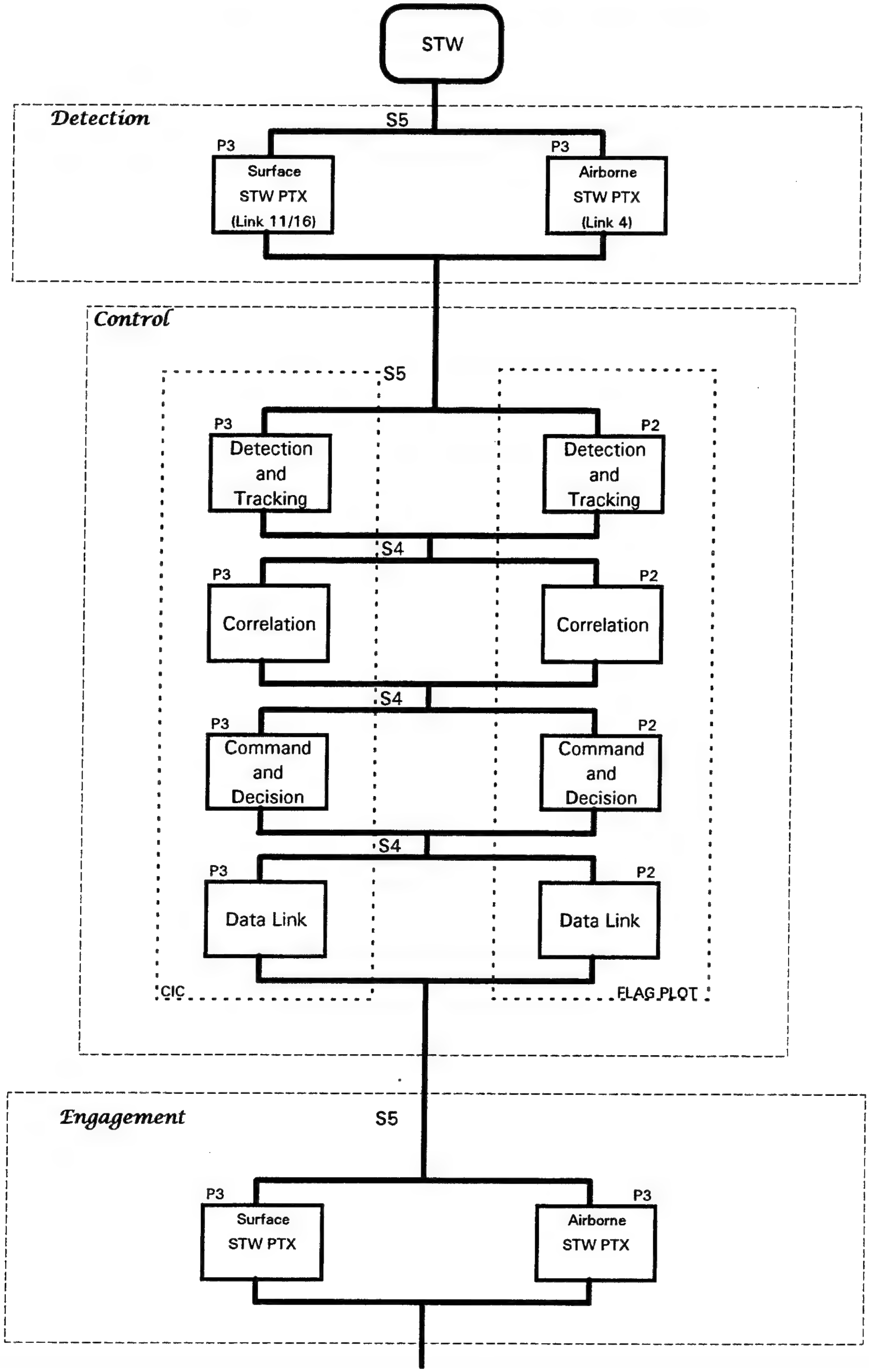


Figure 5-7. CMD AAW Architecture

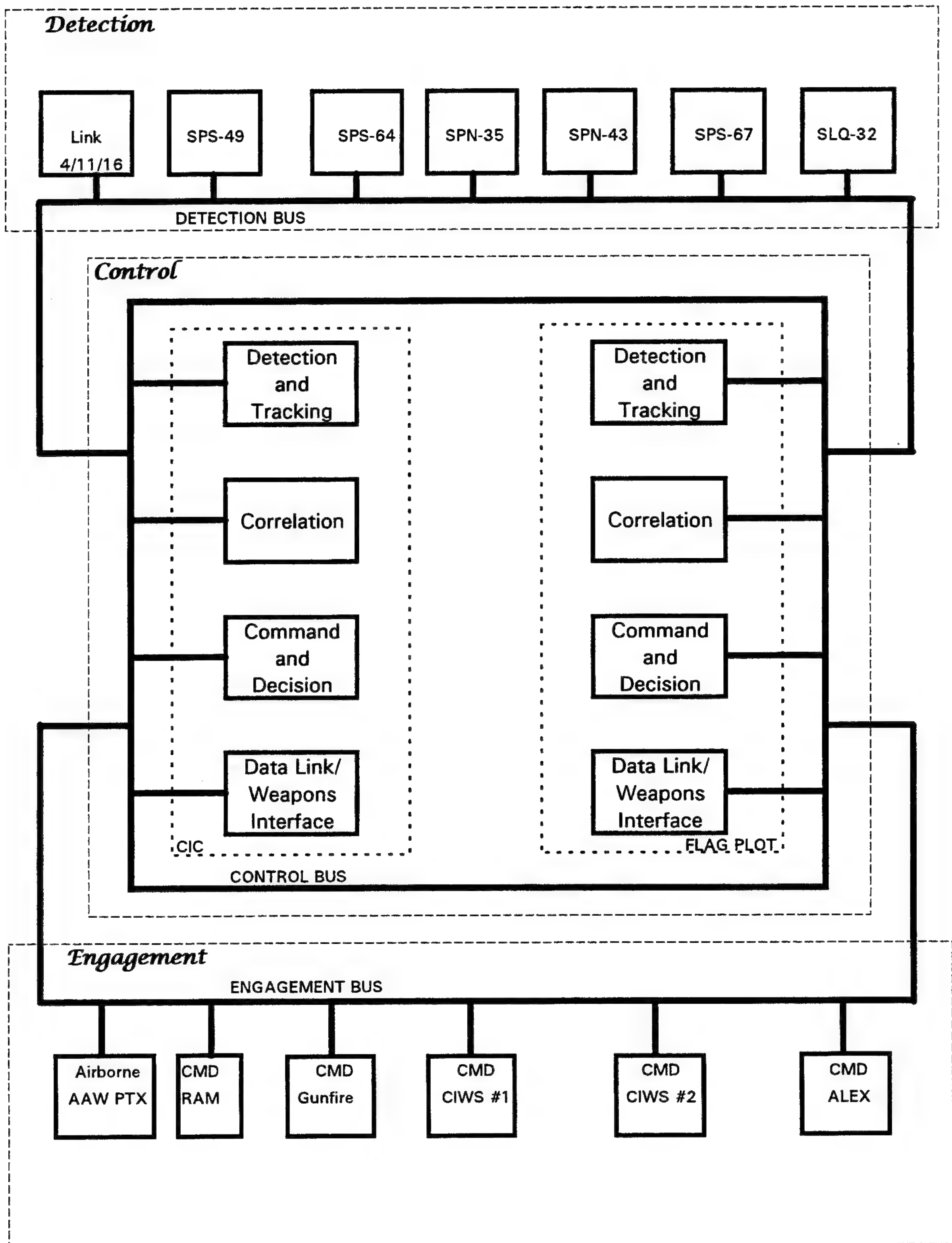


Figure 5-8. CMD ASU Architecture

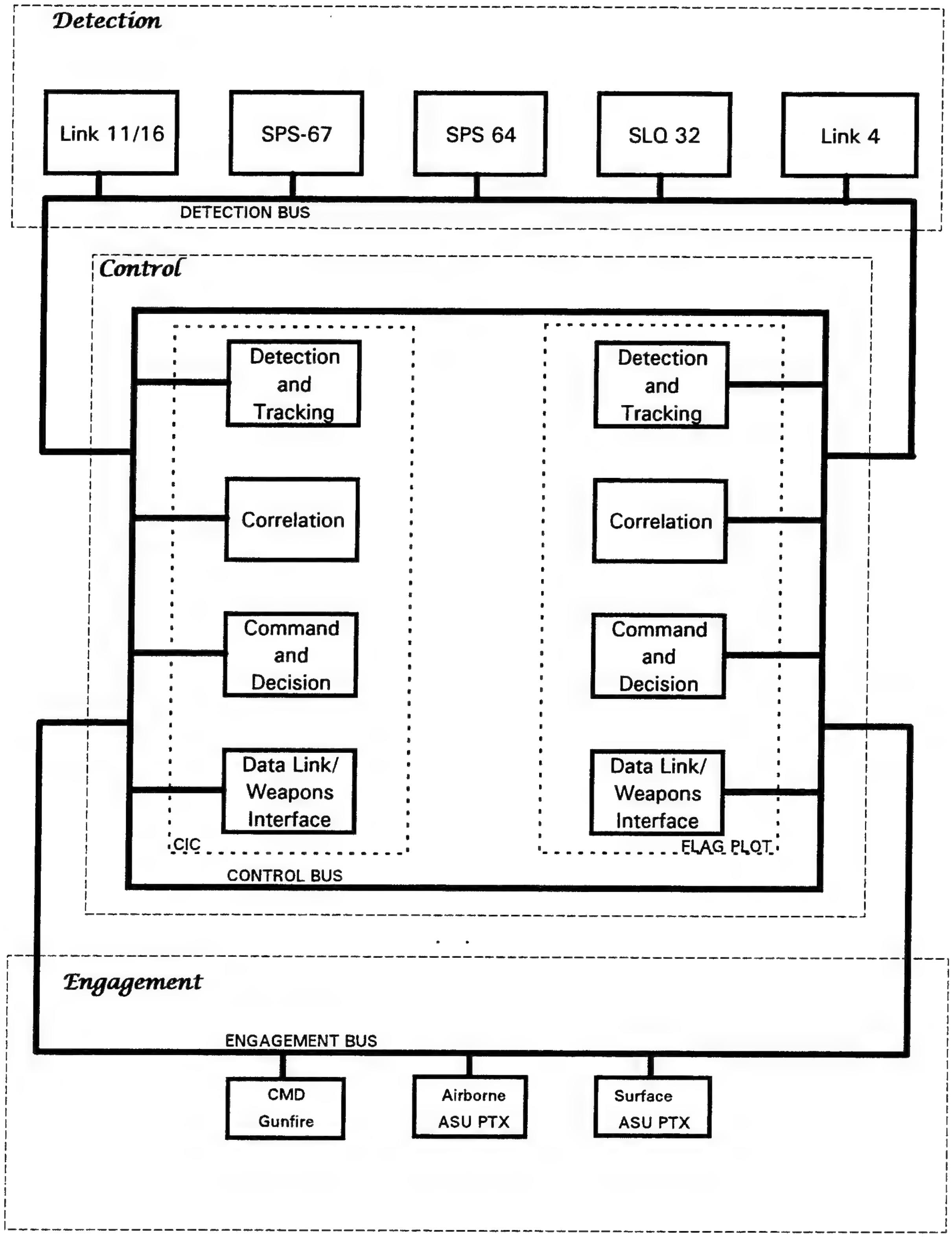


Figure 5-9. CMD ASW Architecture

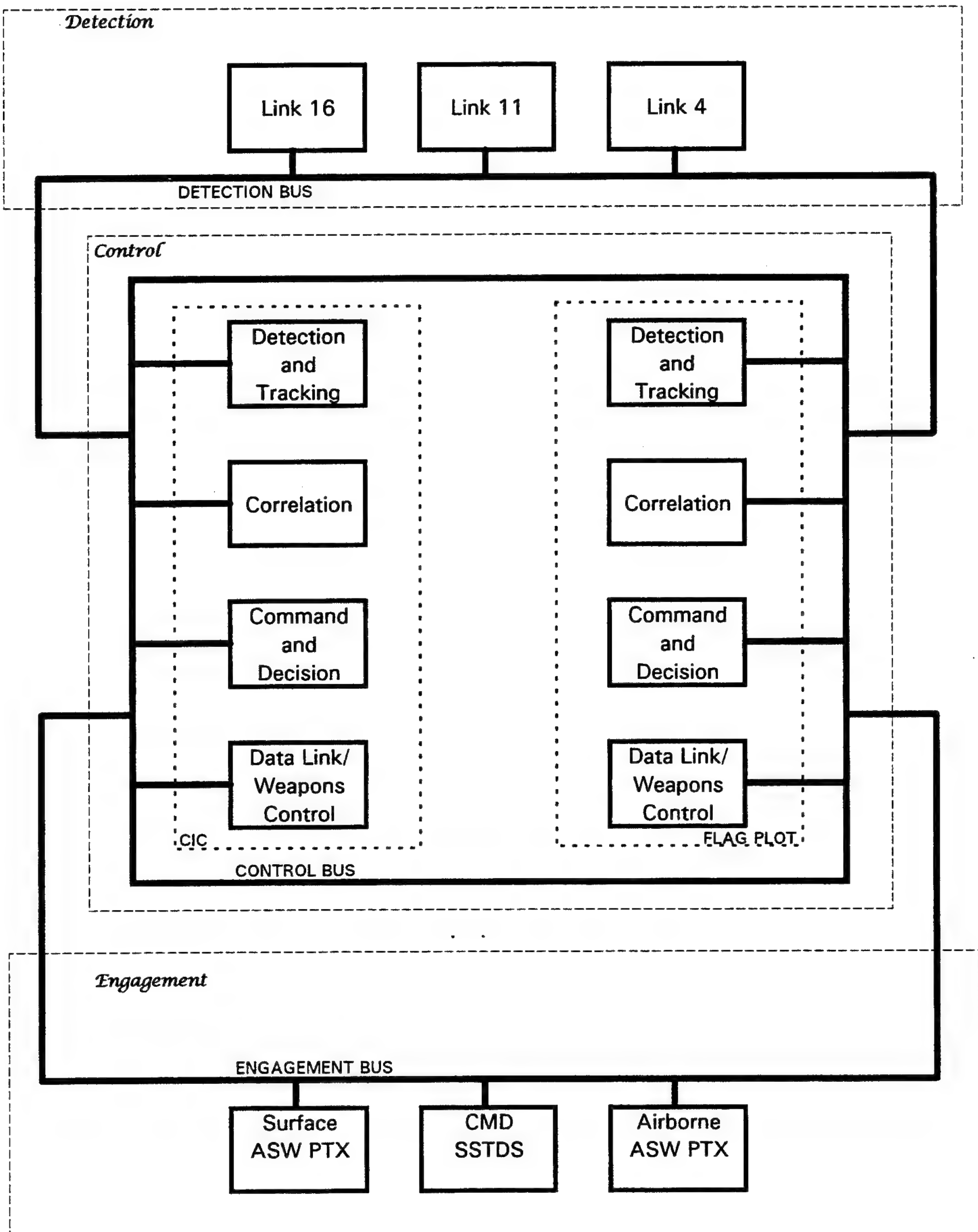


Figure 5-10. CMD INT Architecture

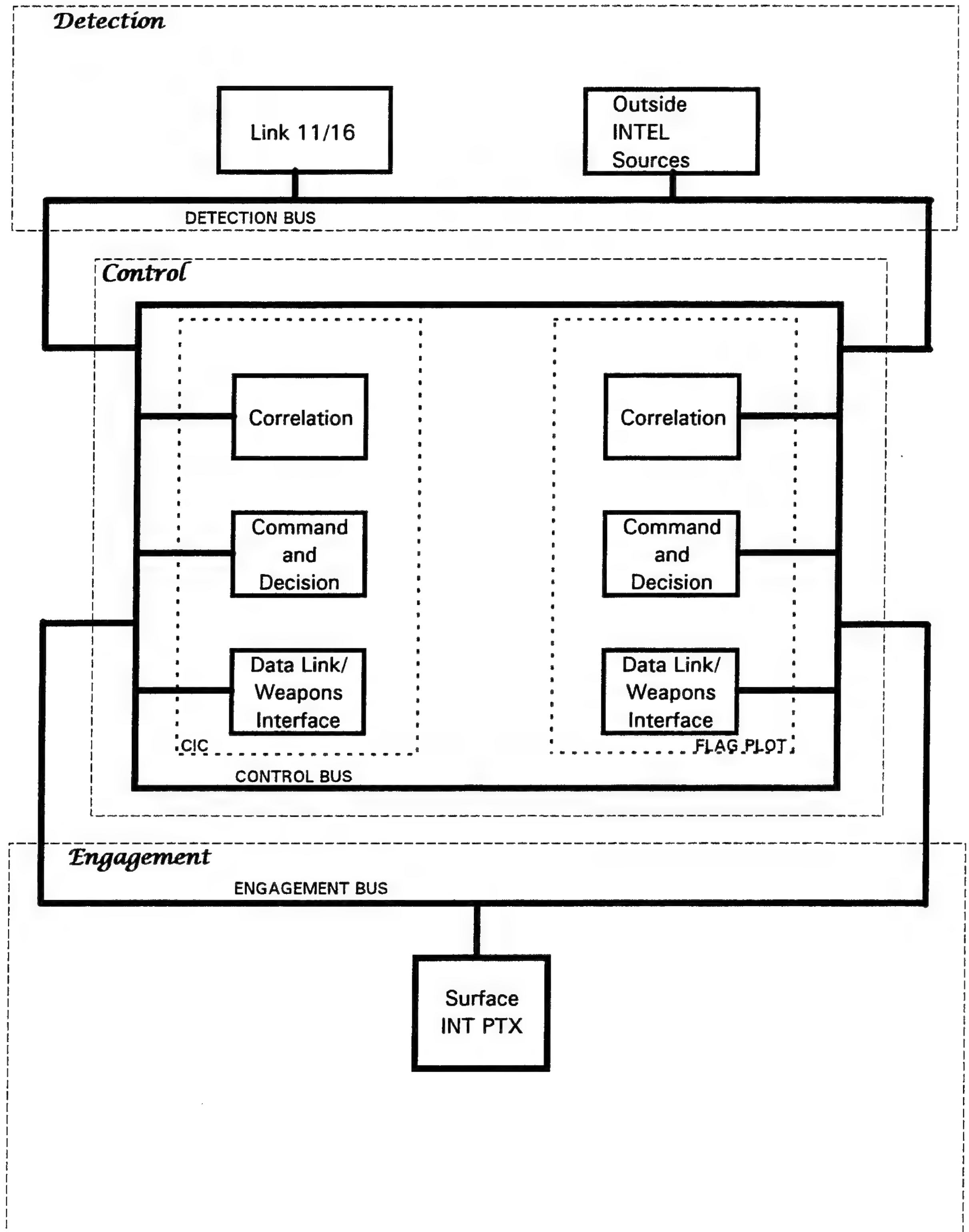


Figure 5-11. CMD MIW Architecture

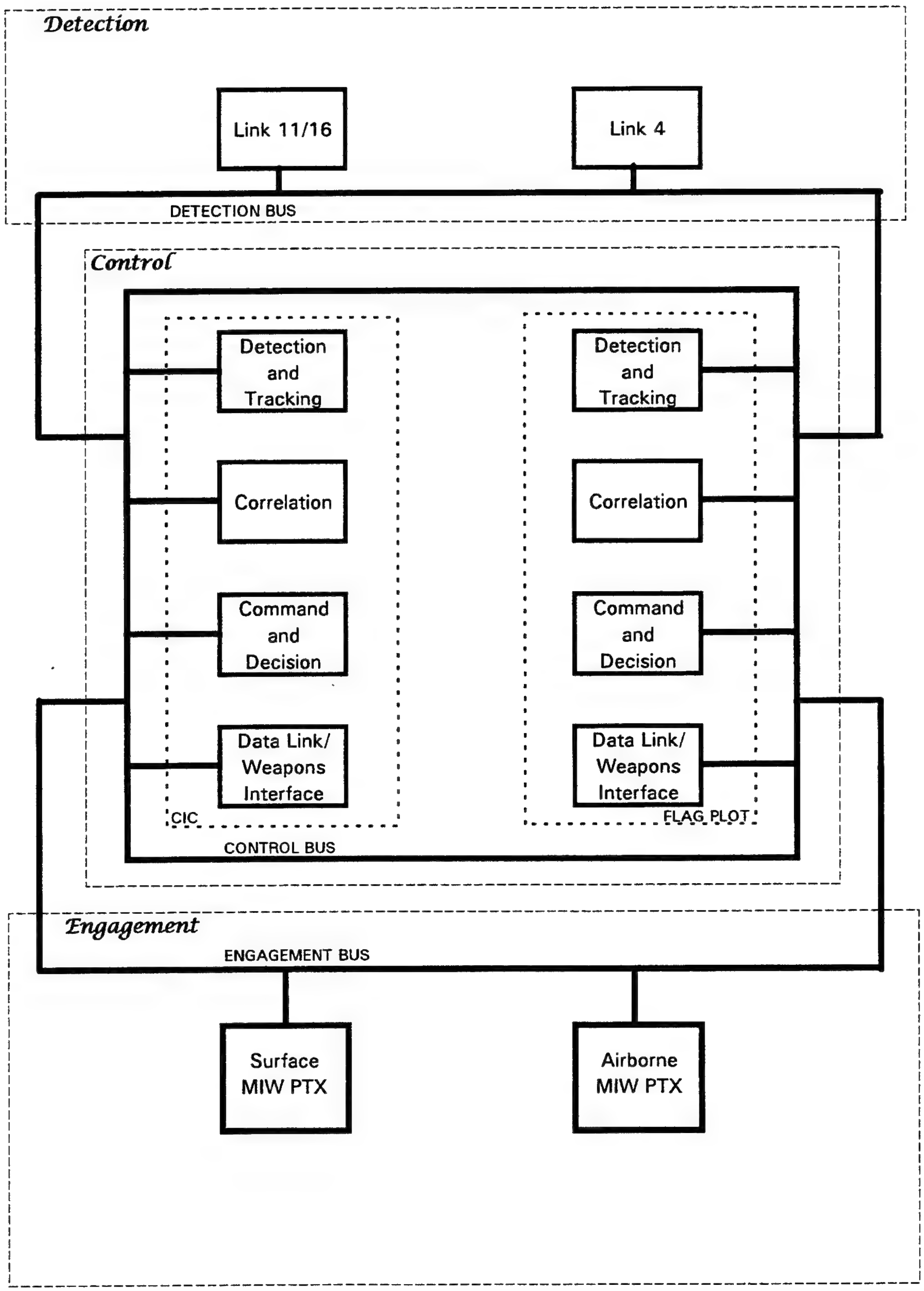


Figure 5-12. CMD STW Architecture

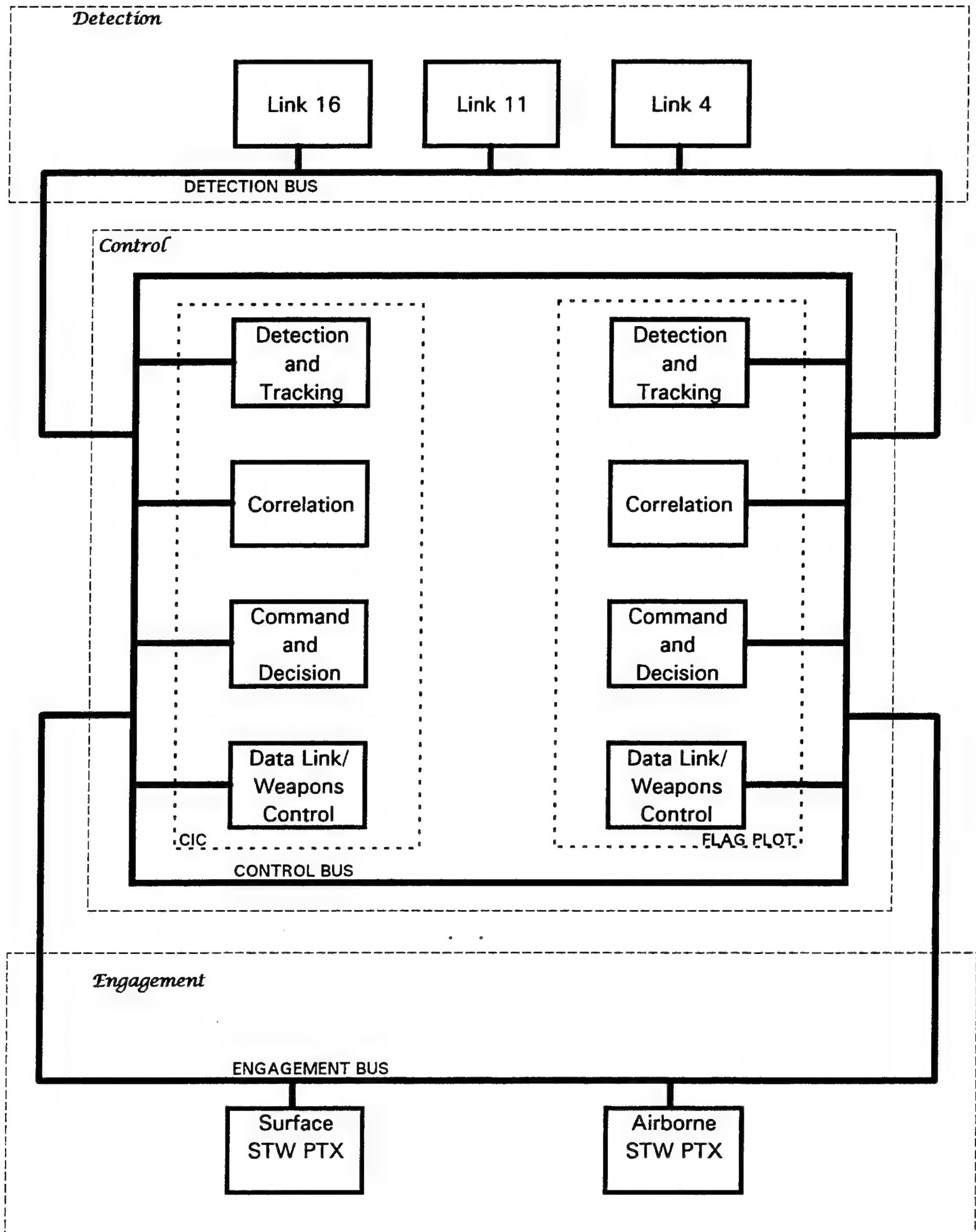


Figure 5–13. Functional Flow Diagram (Tier 0)

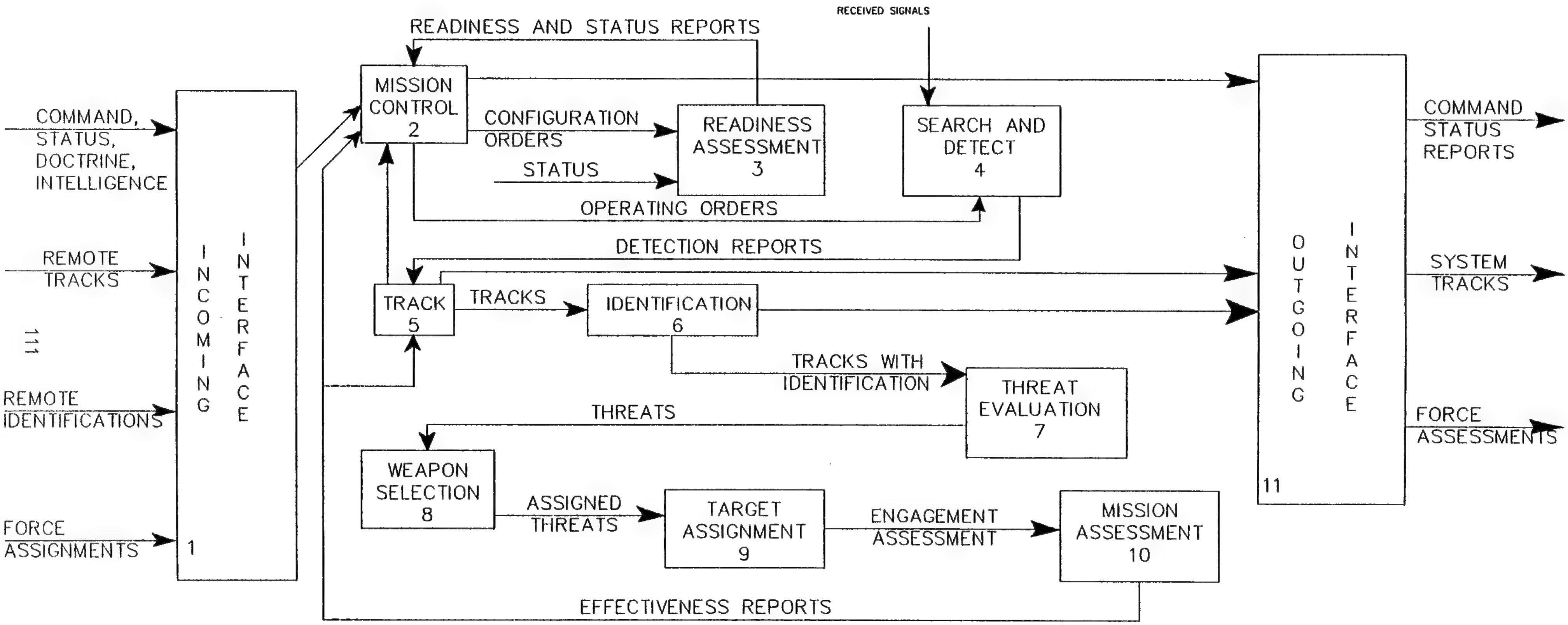


Figure 5-13a. Functional Flow Diagram (Tier 1, Block 1)

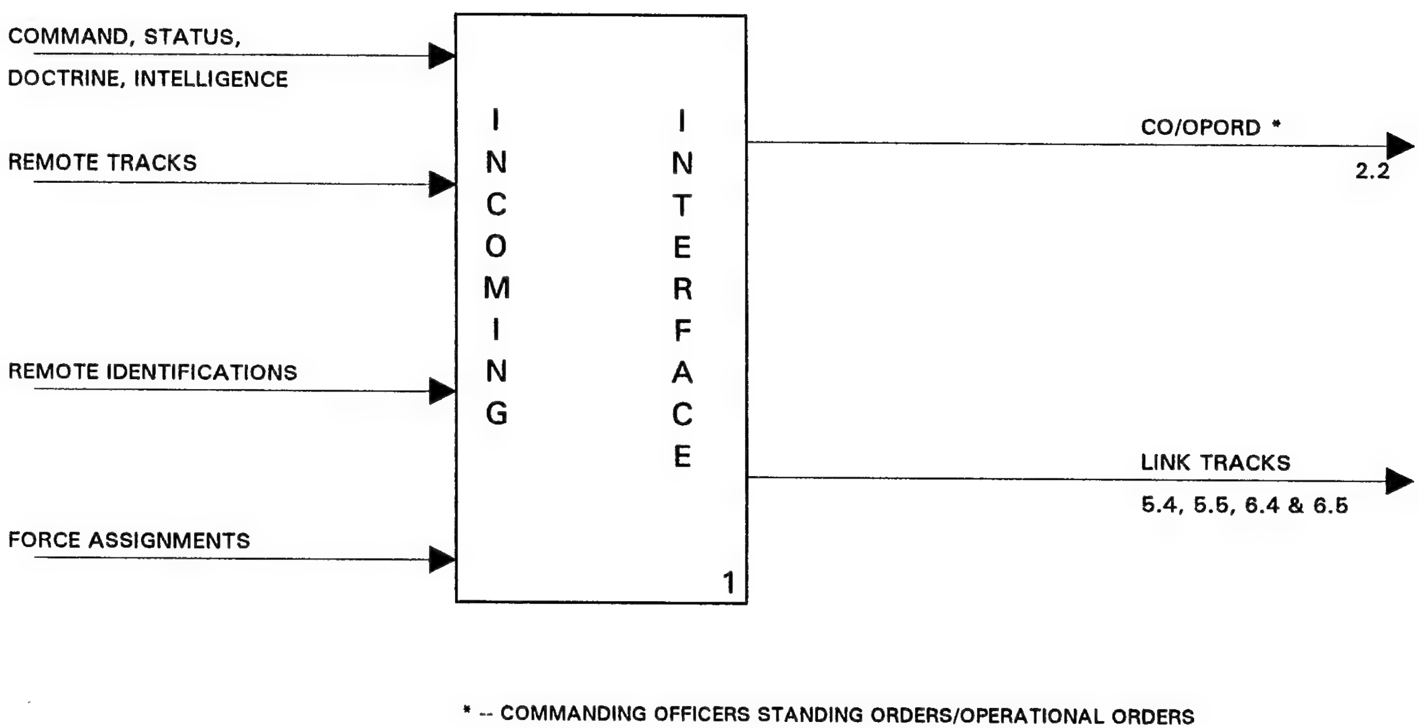
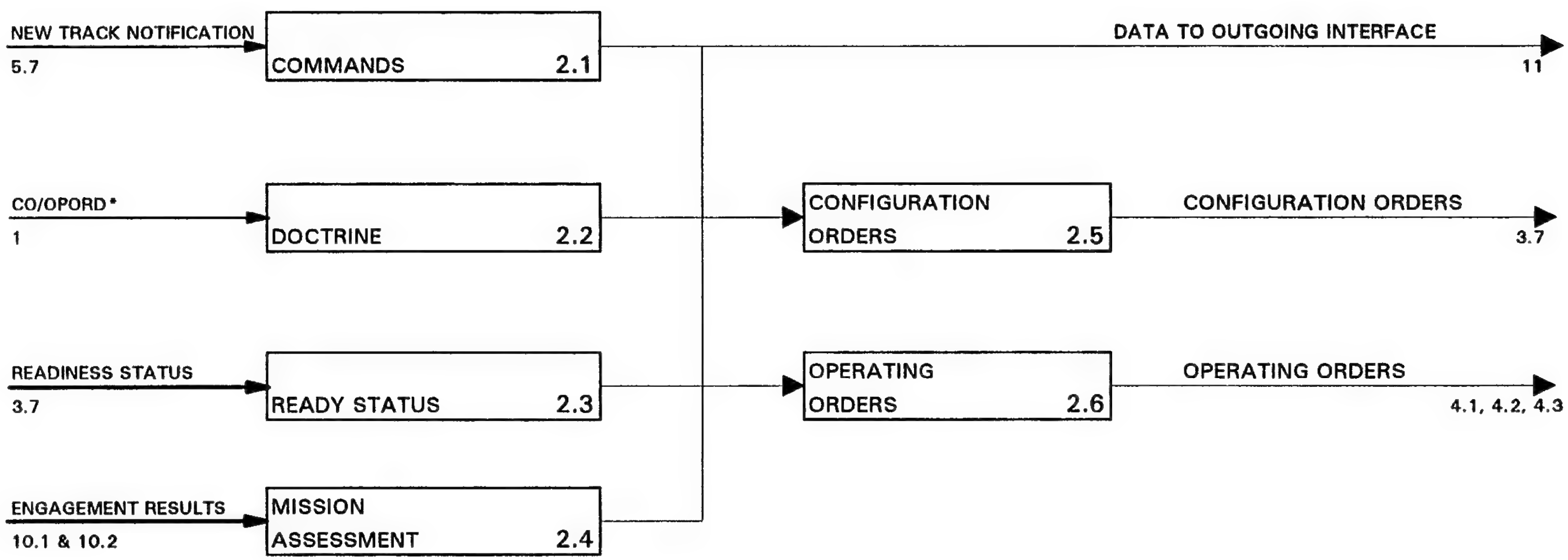


Figure 5-13b. Functional Flow Diagram (Tier 1, Block 2)



*-- COMMANDING OFFICERS STANDING ORDERS/OPERATIONAL ORDERS

Figure 5-13c. Functional Flow Diagram (Tier 1, Block 3)

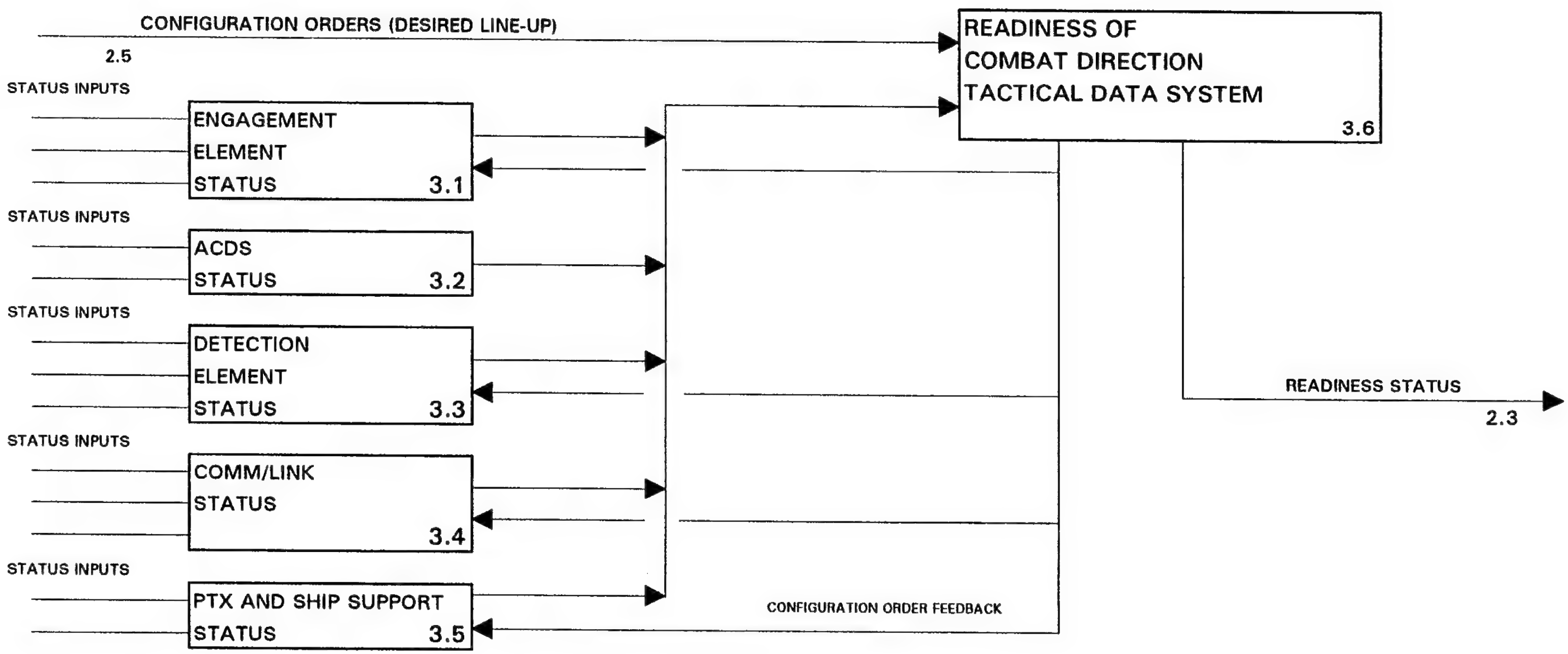


Figure 5-13d. Functional Flow Diagram (Tier 1, Block 4)

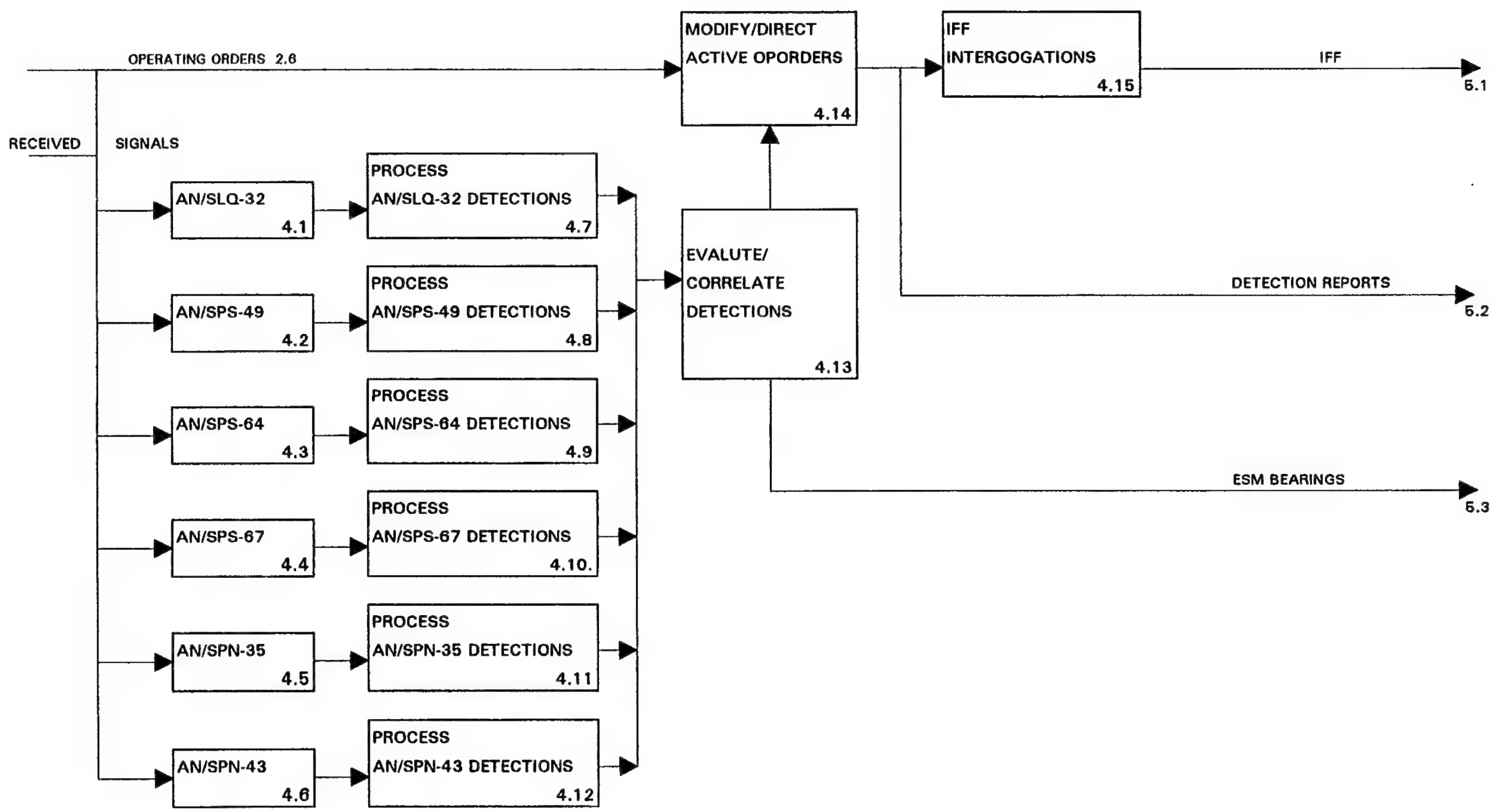


Figure 5-13e. Functional Flow Diagram (Tier 1, Block 5)

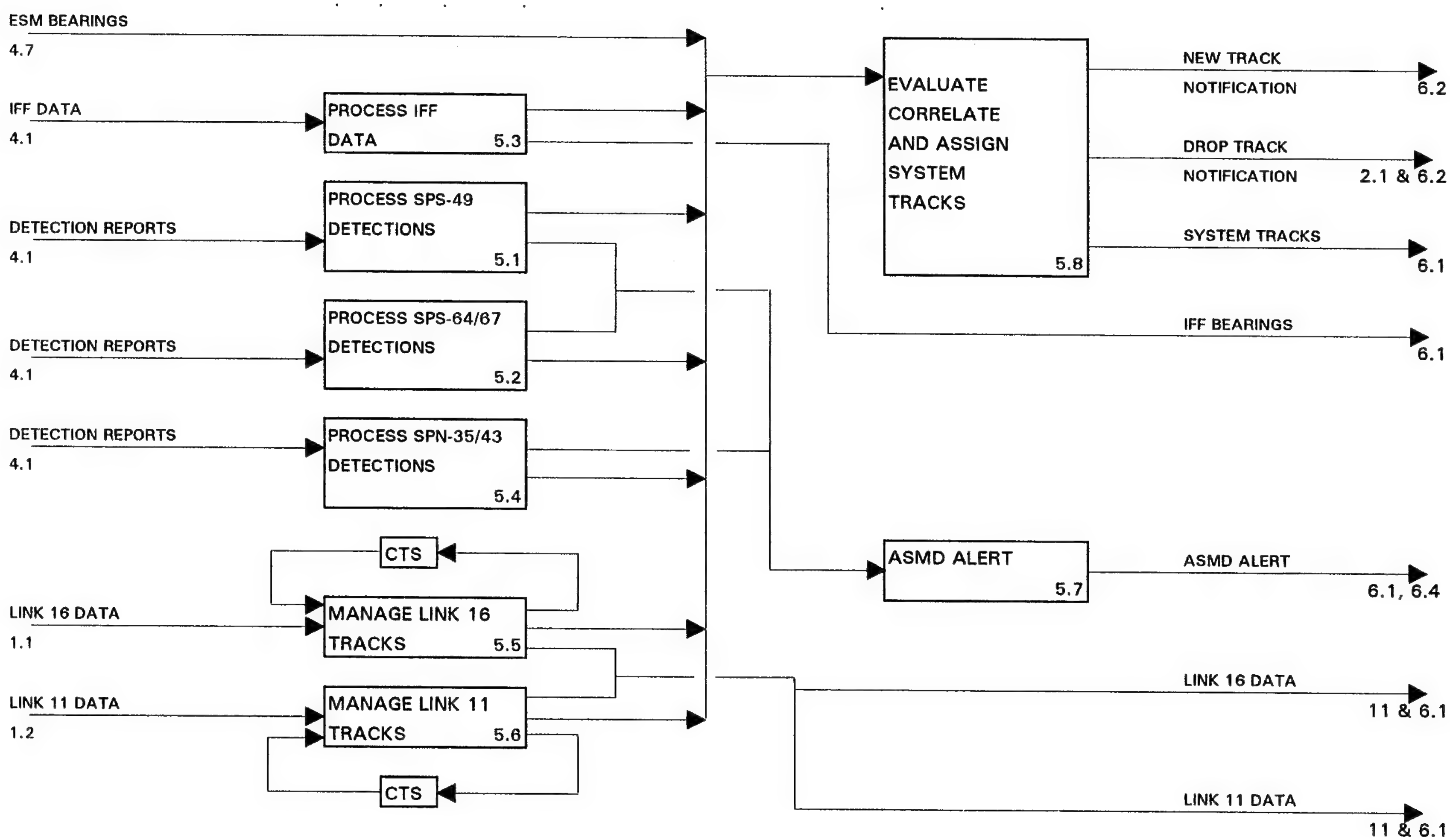


Figure 5-13f. Functional Flow Diagram (Tier 1, Block 6)

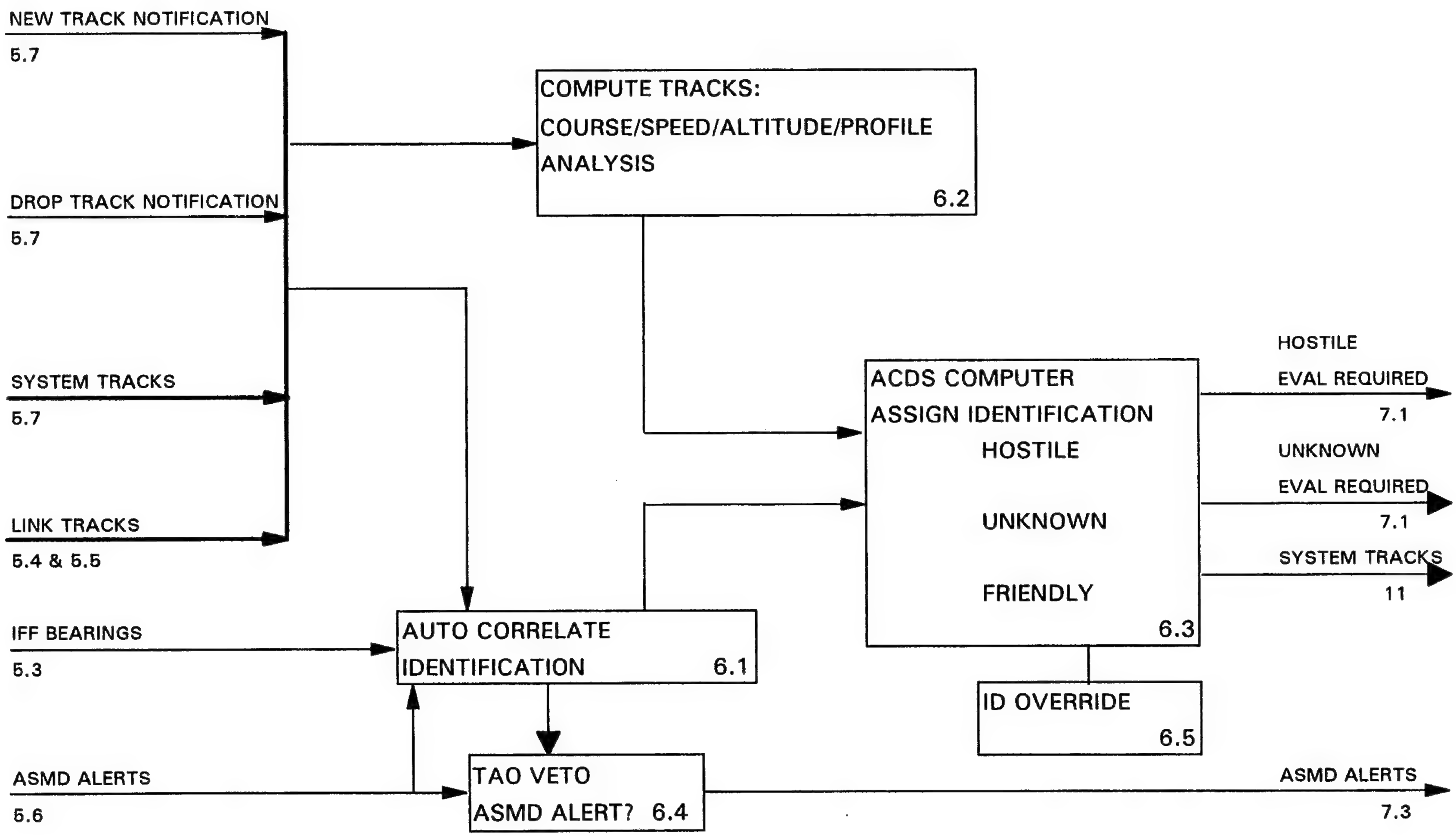


Figure 5-13g. Functional Flow Diagram (Tier 1, Block 7)

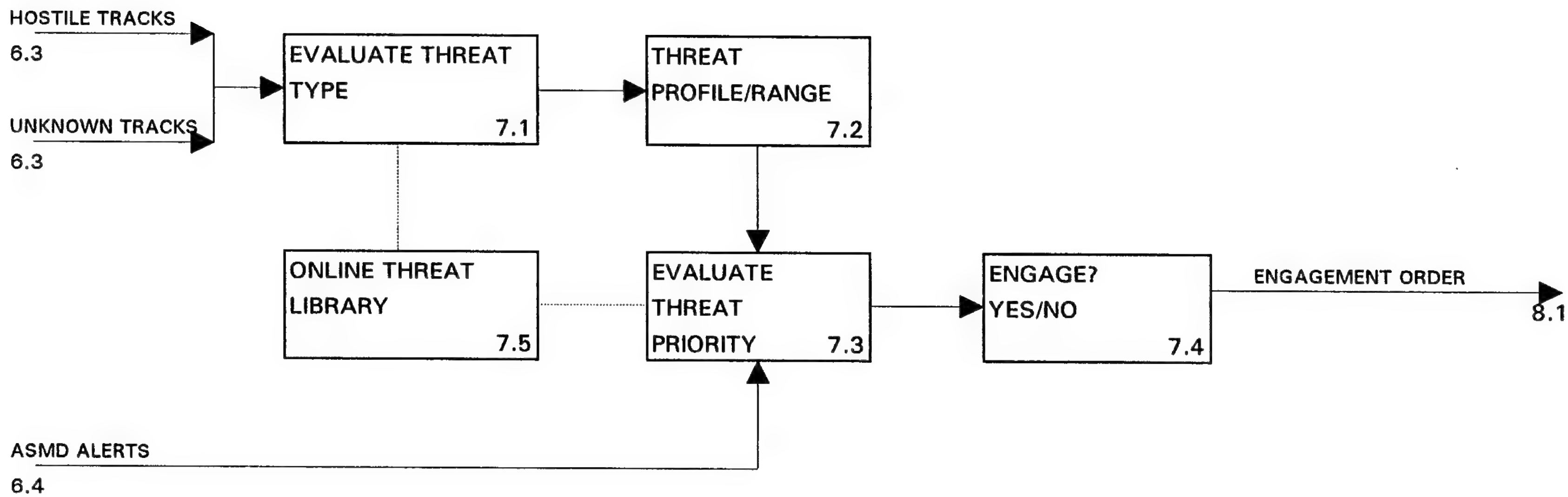


Figure 5-13h. Functional Flow Diagram (Tier 1, Block 8)

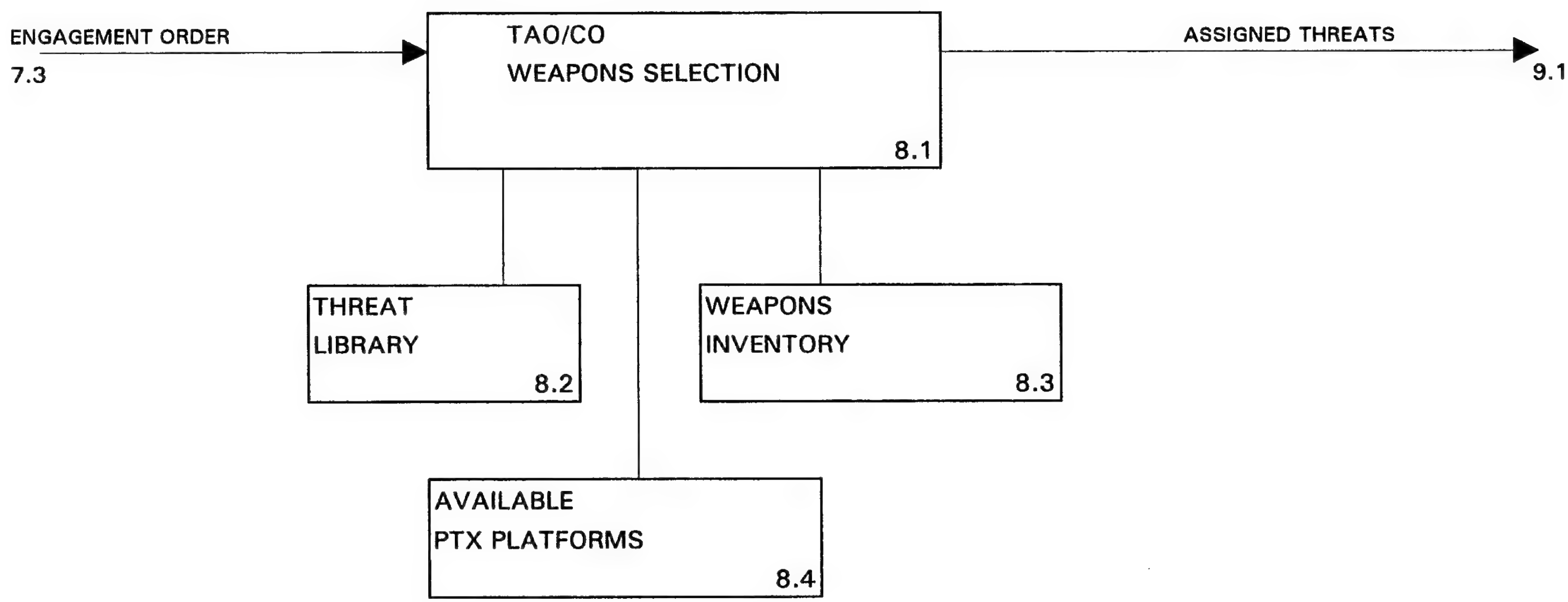


Figure 5-13i. Functional Flow Diagram (Tier 1, Block 9)

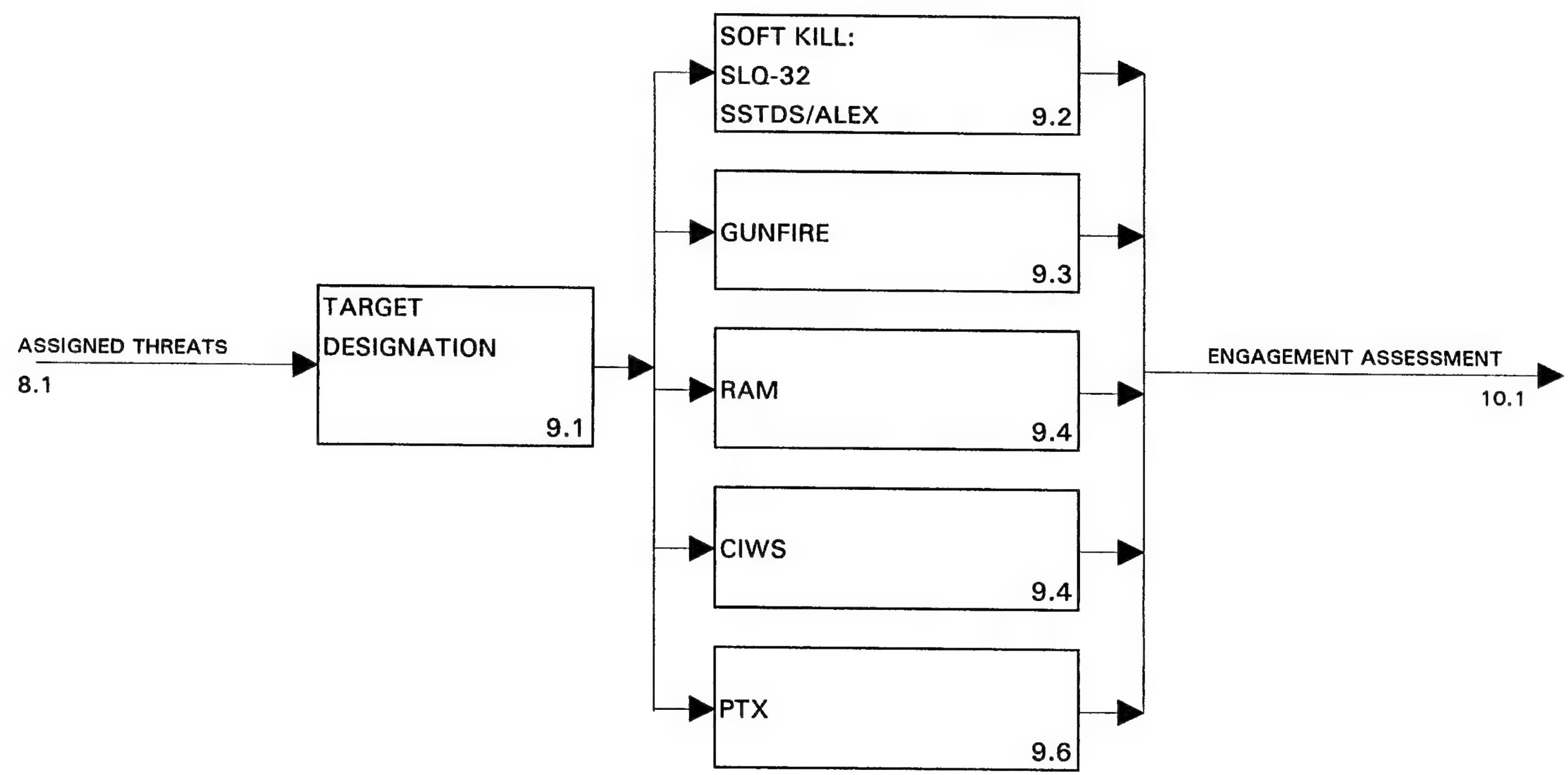


Figure 5-13j. Functional Flow Diagram (Tier 1, Block 10)

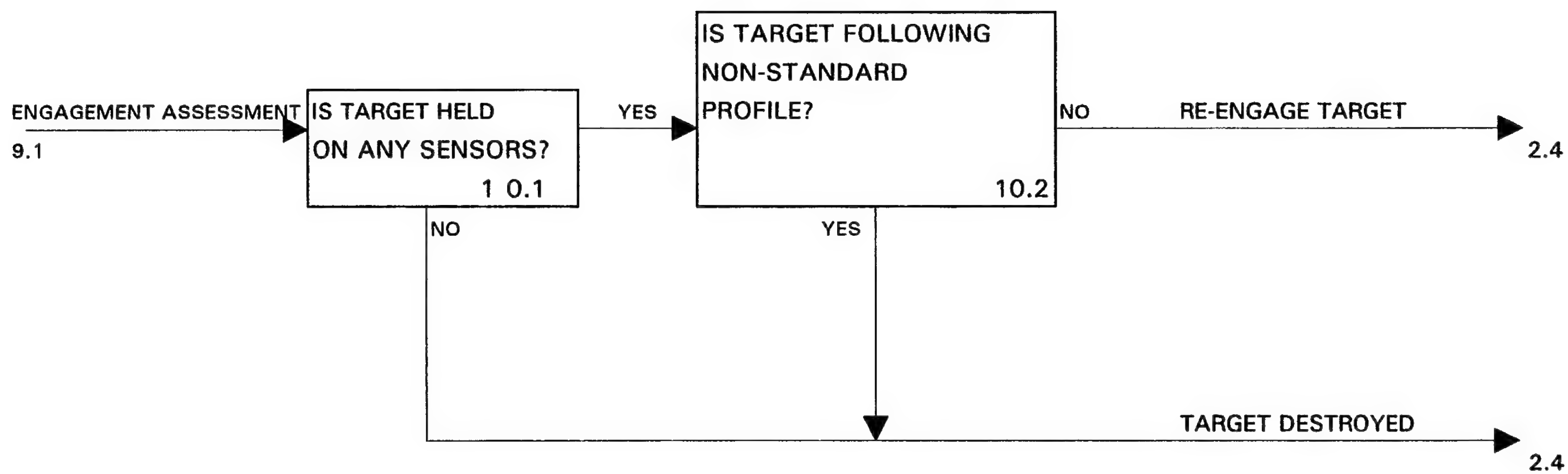
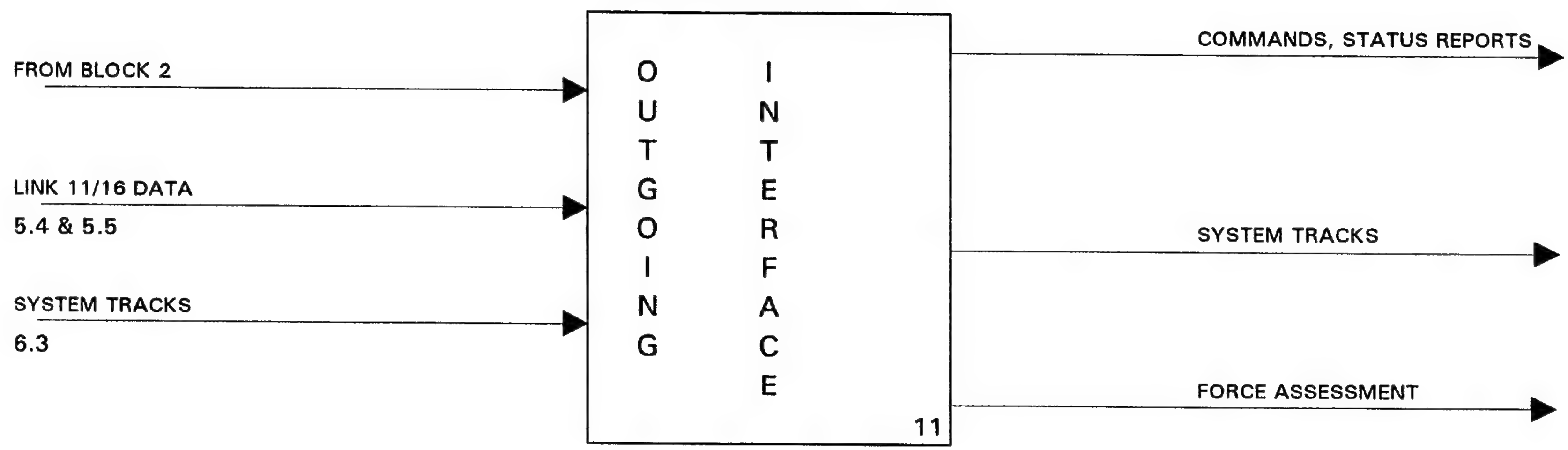


Figure 5-13k. Functional Flow Diagram (Tier 1, Block 11)



C. HULL, MECHANICAL AND ELECTRICAL ARCHITECTURE

1. Power Generation and Distribution System

The CMD propulsion plant and ship service electrical distribution are structured in an Integrated Power Architecture (IPA) consisting of five functional elements: power generation, power distribution, power conversion, power load, system control and information. It can be characterized as a Direct Current Zonal Electrical Distribution system (DC ZED). In general, all power produced will be alternating current which is immediately rectified to direct current. Propulsion power is distributed radially on a propulsion bus, as shown in figure 5-14; ship service generators are connected in a ring bus and power is distributed via zonal architecture. Most loads throughout the ship, including the propulsion motors, are alternating current; therefore, power conversion is made within each zone at local distribution centers. The power plant is primarily controlled from the Central Control Station (CCS).

Electrical power is produced from two types of Power Generation Modules (PGM). The first is a LM-2500 GE gas turbine engine connected to a 20 MW generator; the second is a MTU 16V538 diesel engine connected to a 2000 KW generator. There are four gas turbine engines, two in each Main Machinery Room (MMR) and two diesel engines, one in each Auxiliary Machinery Room (AMR). The generators utilize permanent magnet technology. The propulsion motors are advanced electric permanent magnet synchronous machines that are directly coupled to the propeller shafts. They receive power via Power Converter Modules (PCM) and Power Distribution Modules (PDM).

The ship service electrical distribution system, shown in figure 5-15, is supported via the power generation ring bus to each zone. At appropriate locations, the direct current is converted in PCMs then distributed locally through PDMs or supplied directly as DC, which can be a great beneifit to many combat systems. Vital power loads are serviced from both sides of the bus while non-vital loads are serviced from the closest bus. The distribution system is managed by the Standard Monitoring and Control System (SMCS).

The IPA offers many advantages over conventional mechanical drive and former diesel-electric drive platforms. The primary advantages of the IPA are

Figure 5-14 Propulsion Power Distribution Architecture

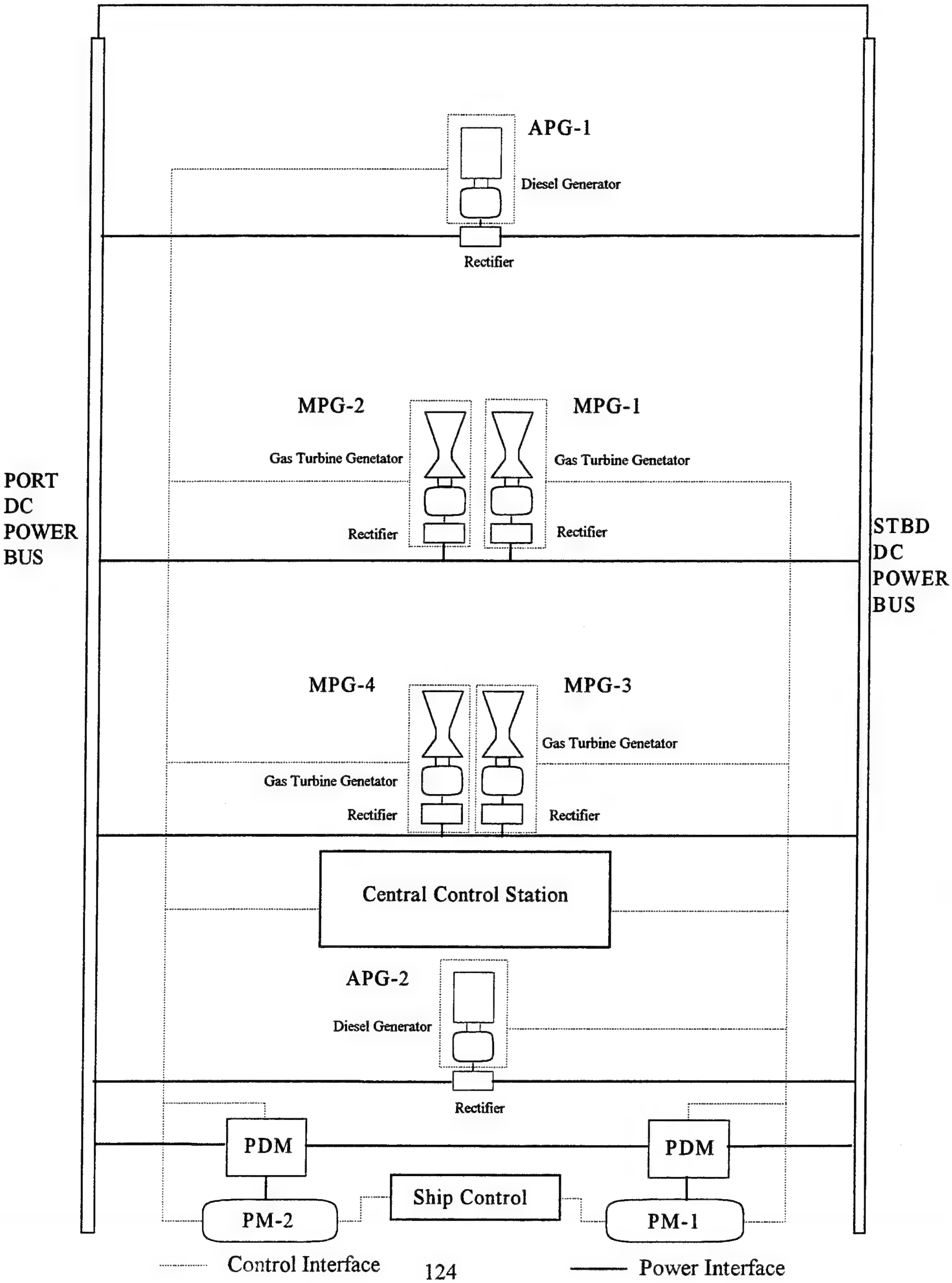
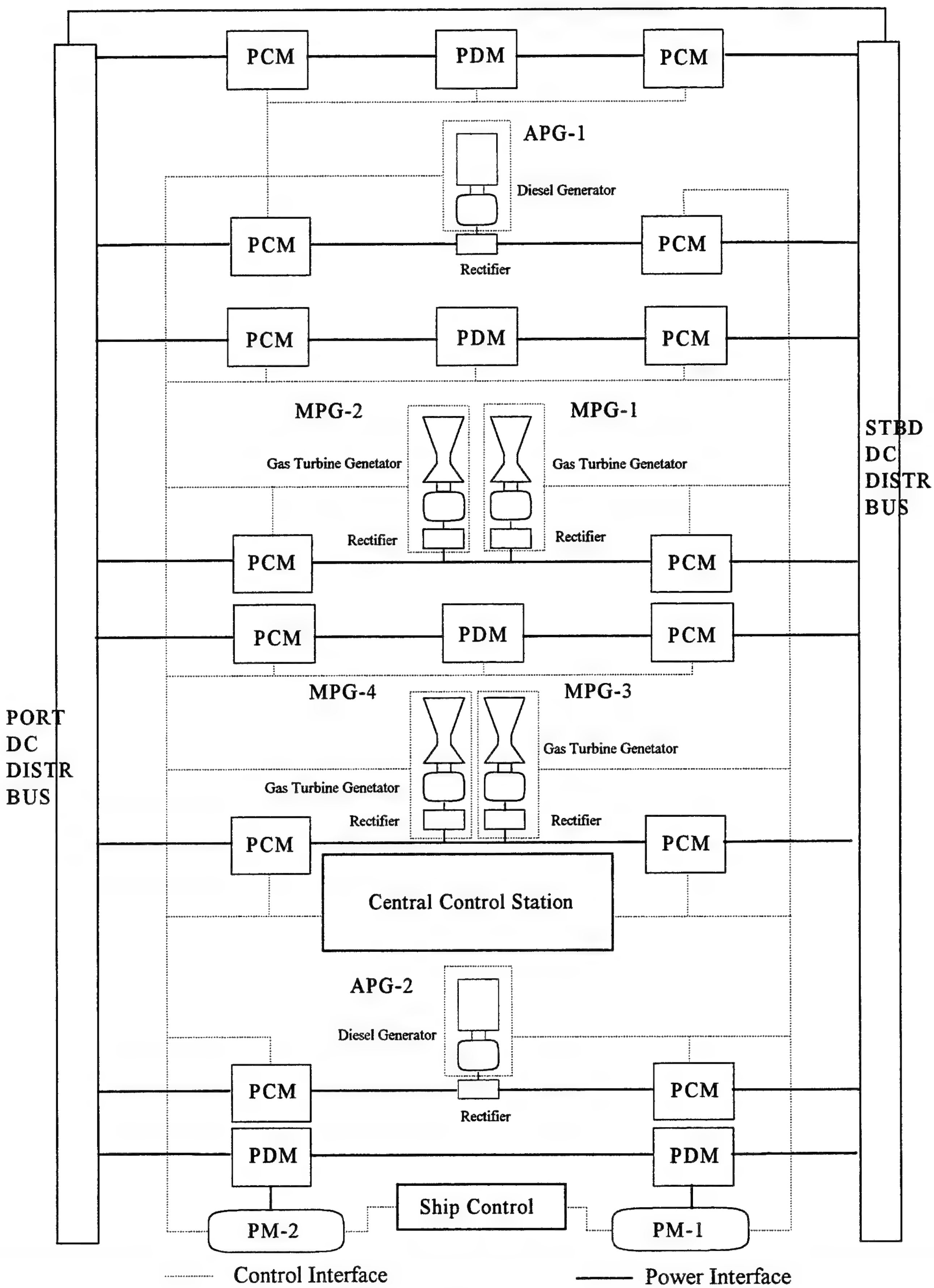


Figure 5-15 Electrical Distribution Architecture



improved economy in aquisition, construction and fuel savings and its ability to support the advanced system control and information data bus. Operationally, these advantages equate to many features. Efficiency and reliability are increased by having flexibility in selecting various combinations of generation units on-line to meet the required load, while at the same time providing redundancy. Survivability is enhanced with the ability to produce both propulsion and ship service electrical power from any machinery room as well as to provide power to either propulsion motor unit. Power plant operation is supported by the systems near instantaneous power transfer abilities and inherent current-limiting protection. Additionally, the control and information data bus offers the ability to manage the plant from many locations in the ship; subject only to the number and inherent capablity of the data consoles and ports installed. Electrical power supplied to the propulsion motor is clean thus reducing the amount of torque noise transmitted through the hull. Electric power is distributed throughout the ship as DC and converted to the appropriate level DC or AC as required.

2. Command, Control, Communication and Instrumentation (C^3I)

The C^3I system provides unparalled ability to manage all combat systems, major power plant systems and ship control systems from a single data bus. It is a Fully Integrated, Fault Tolerant (FIFT) system that runs throughout the ship and is only limited by the level to which local information ports and control consoles are outfitted. It combines control and monitoring of all major electronic and electrical systems on board into one centralized C^3I system. Some of the advantages over existing systems are: fully multiplexed interior communications, centralized ship data for use by all systems, improved reliability and survivability, reduced construction and operating costs, and simplification of man to machine interfaces.

The FIFT C^3I system provides digital real time processing and communications and is to be designed with the intention that it is responsible for mission success and survivability. It consists of the following functional areas: computing and control, communications, input/output, control stations and power distribution. System hardware incorporates generic consoles, central computing group processors and fiber optic data buses.

The following articles provide substantial information regarding current research which forms the basis for the power plant and C^3I systems:

A. Integrated Power System for Marine Applications, N.H. Doerry and J. C. Davis, ASNE Journal, May 1994.

B. Advanced Electric Propulsion, Power Generation and Power Distribution, T. B. Dade, ASNE Journal March 1994.

C. Fully-Integrated, Fault-Tolerant Command, Control, Communication and Instrumentation System for a Nuclear Attack Submarine, M. G. Dauman, ASNE Journal, March 1994.

3. Firemain System

Firemain supply is distributed throughout the ship with a double horizontal loop system. The lower loop circulates along the damge control deck (second deck) and the upper loop along the third level of the superstructure (03 level). Risers on port and starboard sides link the two loops and supply from each machinery space. The distribution system is supplied by six firepumps: one in the aft AMR (AMR2), two in the aft MMR (MMR2) and three additional pumps located in pump rooms in the forward two zones. The system incorporates electrically operated isolation valves at key locations that are controllable from CCS, the Integrated Control and Information System or manually. The system is further managed with manual isolation valves and the ability to provide jumper connections across zones.

4. Ballast Control

Ballasting of the ship is an evolution that is central to the ships primary mission areas. The degree to which trim and well deck water depth can be maintained as well as the speed at which the ship can ballast up or down significantly impacts mission effectiveness. The amount of ballast weight required is estimated at approximately 9,000 tons; this amount is exacerbated by a flared hull form. The system incoporates third deck tanks which are above the water line and six and seventh deck tanks in the inner bottom and skirting the underwater hull. the third deck tanks are filled from the firemain system and gravity drained. the lower deck tanks are seawater filled and drained with low pressure air. Ballast Control Central (BCC) is located on the second deck at the extreme forward end of the well deck. This location provides for complete viewing access of the well deck area. All tank valves are electrically operated from BCC.

5. Equipment Cooling and Air Conditioning

The availability of electronic equipment cooling to combat systems is as important as the supply of electricity; therefore, the concept of enclaving and zonal architecture of combat systems for increased survivability must also be applied to the distribution of support elements. Electronic Cooling Modules (ECM) of appropriate capacity will be located nearby all vital electronic equipment and or spaces. The modules will provide electronic cooling water as well as air conditioning to the space. All other spaces, such as berthing, mess facilities and offices will be supplied with air conditioning on a shipwide distribution system.

6. Additional Comments on Power Plant Computer Models

The ASSET computer program is unable to handle a power off the main bus arrangement; therefore, an attempt to assess the impact of the power plant type on ship speed has been made by incorporating Propulsion Derived Ship Service (PDSS) into the ASSET model using four 1000 KW PDSS generators. The ship service electrical power assesment section of ASSET does not provide realistic capability for any model. This problem had been noted by previous TSSE students as well. To solve this problem the installed electrical power capability is assigned using past experience and discussion with engineers during ship tours. It is expected that normal underway operations will be made with any combination of main engines (gas turbines) on-line.

It is expected that operational achorage loads can be met with one secondary engine (diesel) supplying ship service power. The diesel engine has been selected because an appropriately size gas turbine is not available (i.e. Solar Saturn at 750 KW or Allison 501 at 2700 KW). Additionally, two diesels vice one larger gas turbine allows for power generation in any of the four enclaving zones.

7. Power Plant Equipment Listing

The power plant equipment list for the main machinery, auxiliary machinery and motor rooms is provided in tables 5-3 through 5-8.

TABLE 5-3 Forward Main Machinery Room (MMR1)

EQUIPMENT	NUMBER INSTALLED
Power Generation Module: LM-2500 with 20 MW Generator	2
Power Conversion Modules	As Required
Power Distribution Modules	As Required
Lube Oil Scavenging System (LOSCA)	1
Fuel Oil Service Tank/Purifier/Pump	2
Fuel Oil Transfer Pump	2
Air Conditioning Plant	1
High Pressure Air Compressor	1
Ships Service Low Pressure Air Compressor	1
Ballast Low Pressure Air Compressor	1

TABLE 5-4 Aft Main Machinery Room (MMR2)

EQUIPMENT	NUMBER INSTALLED
Power Generation Module: LM-2500 with 20 MW Generator	2
Power Conversion Modules	As Required
Power Distribution Modules	As Required
Firepump	2
Reverse Osmosis Distilling Plant	1
Potable Water Pump	2
Lube Oil Scavenging System (LOSCA)	1
Fuel Oil Service Tank/Purifier/Pump	2
Fuel Oil Transfer Pump	2
Eductor	1
Air Conditioning Plant	1
High Pressure Air Compressor	1
Ships Service Low Pressure Air Compressor	1
Ballast Low Pressure Air Compressor	1

TABLE 5-5 Forward Auxiliary Machinery Room (AMR1)

EQUIPMENT	NUMBER INSTALLED
Power Generation Module: MTU-16V538 with 2000 KW Generator	1
Power Conversion Modules	As Required
Power Distribution Modules	As Required
Lube Oil Purifier	1
Lube Oil Storage Tank	1
Fuel Oil Service Tank/Pump	2
Diesel Jacket Water Pump	2
Air Conditioning Plant	1
Ships Service Low Pressure Air Compressor	1
Ballast Low Pressure Air Compressor	1

TABLE 5-6 Aft Auxiliary Machinery Room (AMR2)

EQUIPMENT	NUMBER INSTALLED
Power Generation Module: MTU-16V538 with 2000 KW Generator	1
Power Conversion Modules	As Required
Power Distribution Modules	As Required
Firepump	1
Reverse Osmosis Distilling Plant	1
Potable Water Pump	2
Lube Oil Purifier	1
Lube Oil Storage Tank	1
Fuel Oil Service Tank/Pump	2
Diesel Jacket Water Pump	2
Eductor	1
Air Conditioning Plant	1
Ships Service Low Pressure Air Compressor	1
Ballast Low Pressure Air Compressor	1

TABLE 5-7 Starboard Propulsion Motor Room (PMR1)

EQUIPMENT	**NUMBER INSTALLED**
Propulsion Motor	1
Power Conversion Modules	As Required
Power Distribution Modules	As Required
Motor Cooling System	1
Motor Lubricating System	1
Eductor (shared with other PMR)	1

TABLE 5-8 Port Propulsion Motor Room (PMR2)

EQUIPMENT	**NUMBER INSTALLED**
Propulsion Motor	1
Power Conversion Modules	As Required
Power Distribution Modules	As Required
Motor Cooling System	1
Motor Lubricating System	1
Eductor (shared with other PMR)	1

D. ARRANGEMENTS

The arrangements for the CMD are divided into five sub groups; topside, H,M &E, combat systems, well deck and miscellaneous. Each of these is illustrated by drawings in this section. Detailed drawings of Combat Information Center (CIC), the bridge, and the Central Control Station (CCS) are provided in subsection F.

1. Topside Arrangements

The topside arrangements are shown in figure 5-16. The CMD has two masts, one located just aft of the bridge and the second located above the hangar space. Both masts are on the ships centerline and cantered aft at 13 degrees.

The SPN-35 and SPN 43 (3-D air search radars) are located on the aft mast to provide for a large area of coverage but more significantly to provide a complete viewing zone of the flight deck.

The forward mast supports the SPS-49 (2-D air search radar), the SPS-67 (surface search radar), the Mk 92 CAS antenna (for 76mm gun), TACAN and various other communication antennas. The SPS-64 (navigation radar) is mounted above the bridge on its own pedestal type mount.

The two CIWS (close in weapons system) mounts are located above the hangar with one placed on the port side and one on the starboard. These locations provide a good area of coverage and do not interfere with helo operations.

A RAM (rolling airframe missile) launcher is located in the platform forward of the bridge on the 02 level and another is located aft and to starboard of the after mast on the hangar. These two locations increase the area of coverage for point defense.

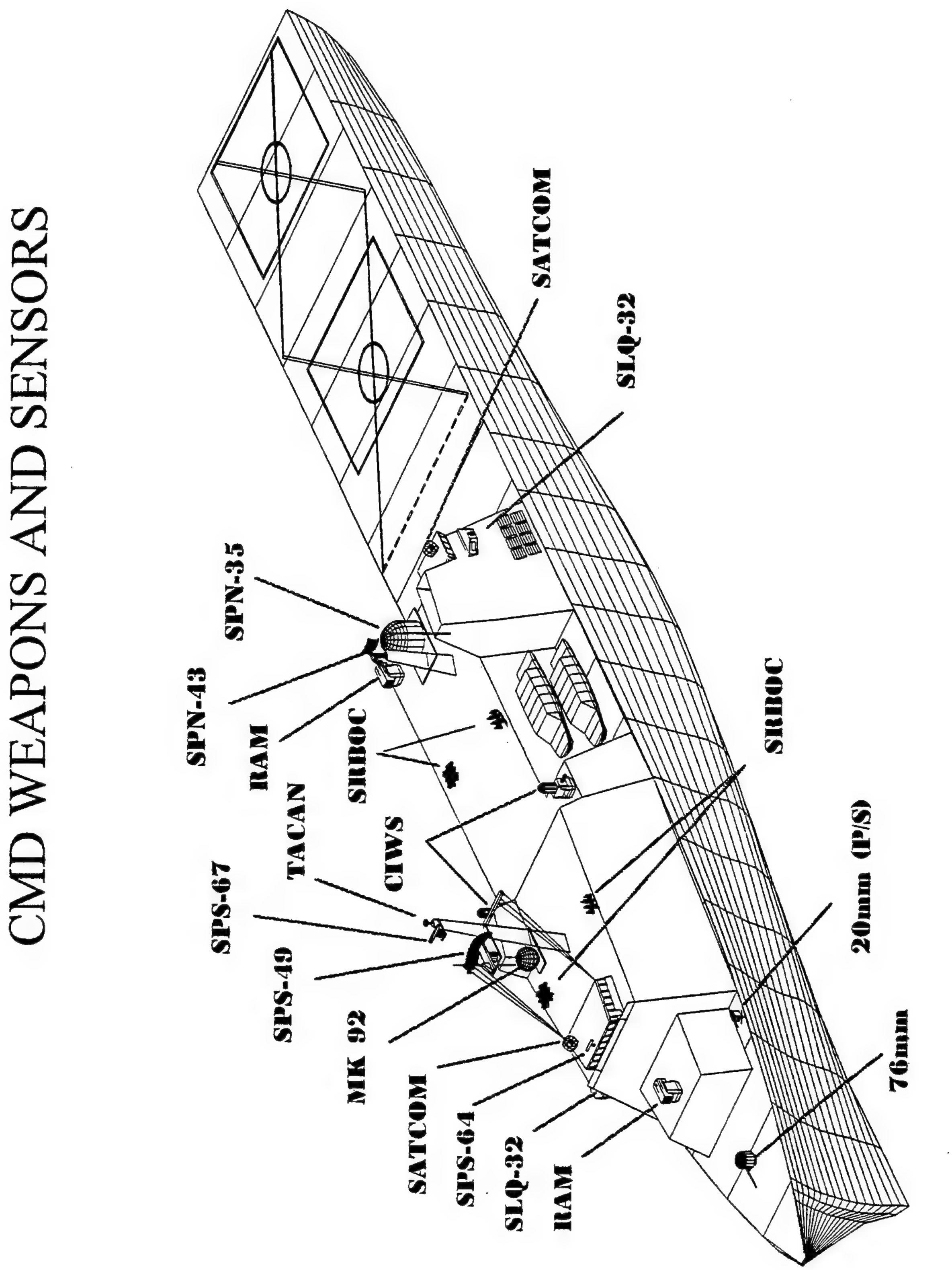
The 76 mm gun is located on the forecastle area of the main deck. It was not possible to locate the Mk 92 CAS within the same structural zone as the 76 mm gun. The guns arc of coverage is almost 225 degrees which provides for flexibility in its use.

Each SRBOC launcher consists of six tubes and are positioned to provide for maximum effectiveness. Two launchers are located on the forward mast platform on the 04 level and two are positioned on top of the hangar on the 03 level.

Two surface patrol (INT) PTX craft craft are stored on the port side of the hangar on the main deck. These will serve as ready lifeboats in the case of personnel overboard.

Bushmaster 25 mm machine guns will be placed in accessible areas in various locations as deemed necessary by ship operators.

Figure 5-16. Topside Arrangements



The arcs of coverage for detection elements and engagement elements are shown in figures 5-17 and 5-18.

2. Hull, Mechanical and Electrical Arrangements

The H,M &E arrangements are shown in figures 5-19 through 5-23. Each machinery room is capable of supporting itself with equipment located in its own zone.

The forward Auxiliary Machinery Room (AMR1) is located in zone I on the second and third decks. The forward Main Machinery Room (MMR1) is located in zone II on the third and fourth decks. The aft Main Machinery Room (MMR2) is located in zone III on the sixth and seventh decks, below the well deck. The aft Auxiliary Machinery Room (AMR2) is located in zone IV on the sixth and seventh decks. The two PMRs (Propulsion Motor Rooms) are located in zone IV on the sixth and seventh decks. The steering gear rooms are located in zone IV on the sixth deck with equipment removal hatches in the bottom of the well deck.

Gyro rooms are located adjacent to CIC and flag plot (one in zone I and one in zone II) with the IC room adjacent to the forward gyro room.

The CCS (Central Control Station) is loacted on the second deck above the forward MMR. It will act as Damage Control central as well as the central control station for machinery operations.

Power Distribution Modules (PDMs) are located adjacent to each machinery room with Power Conversion Modules (PCMs) dispersed throughout the ship to provide separation and redundancy of operations.

Ballast control is located on the second deck aft of the CCS and positioned in a way to provide complete viewing of the well deck at all times.

Firemain pumps are dispersed throughout the ship to provide sufficient fire fighting capability in each zone. Two firemain pumps are located in MMR2, one in AMR2, one in the forward pump room and two in the after pump room.

3. Combat Systems Arrangements

The general combat system arrangements are shown in figures 5-19 and 5-23. CIC is located on the 02 level below and aft of the bridge. It is surrounded by other non vital spaces to provide added protection and increased survivability. A detailed layout of CIC is provided in subsection F.

Figure 5-17. Arcs of Coverage (Detection Elements)

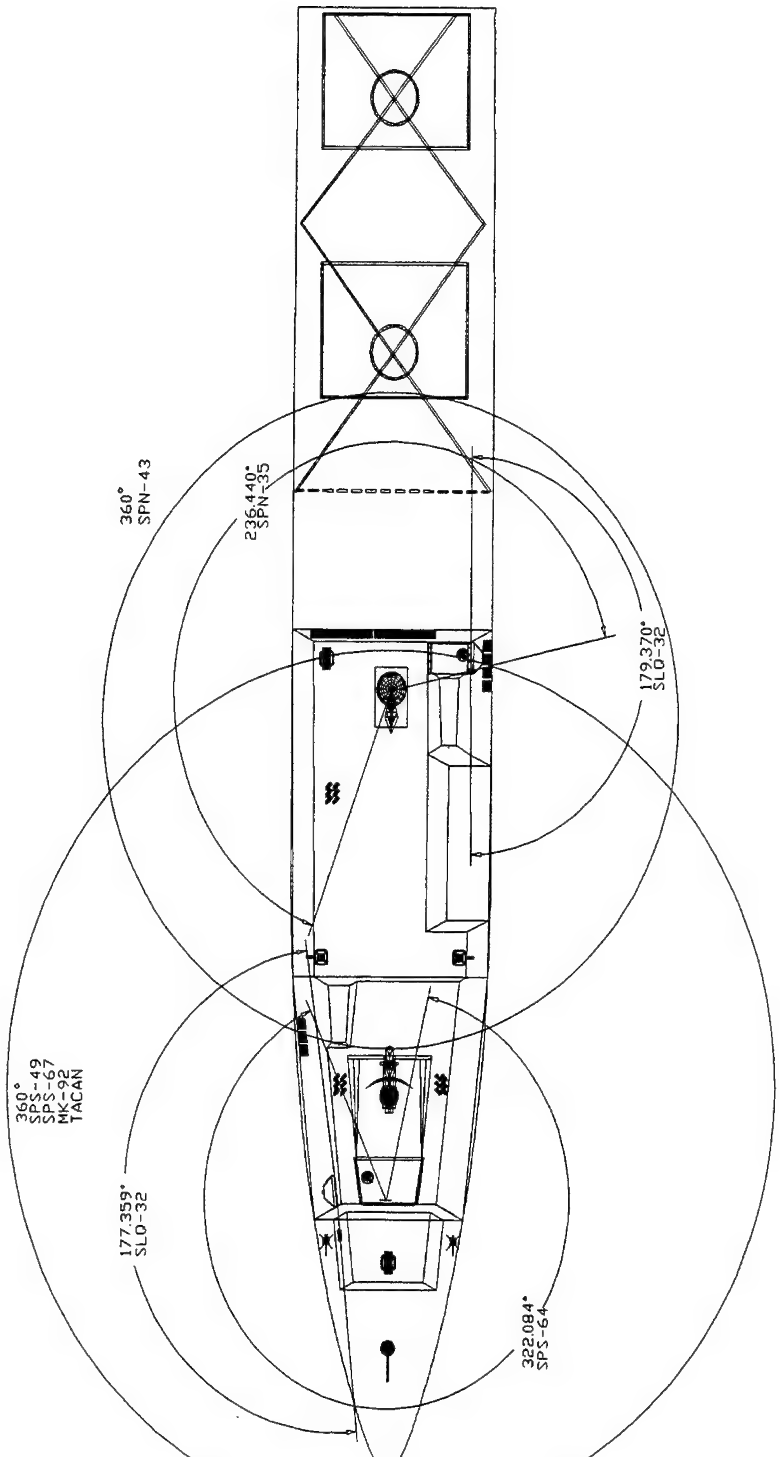
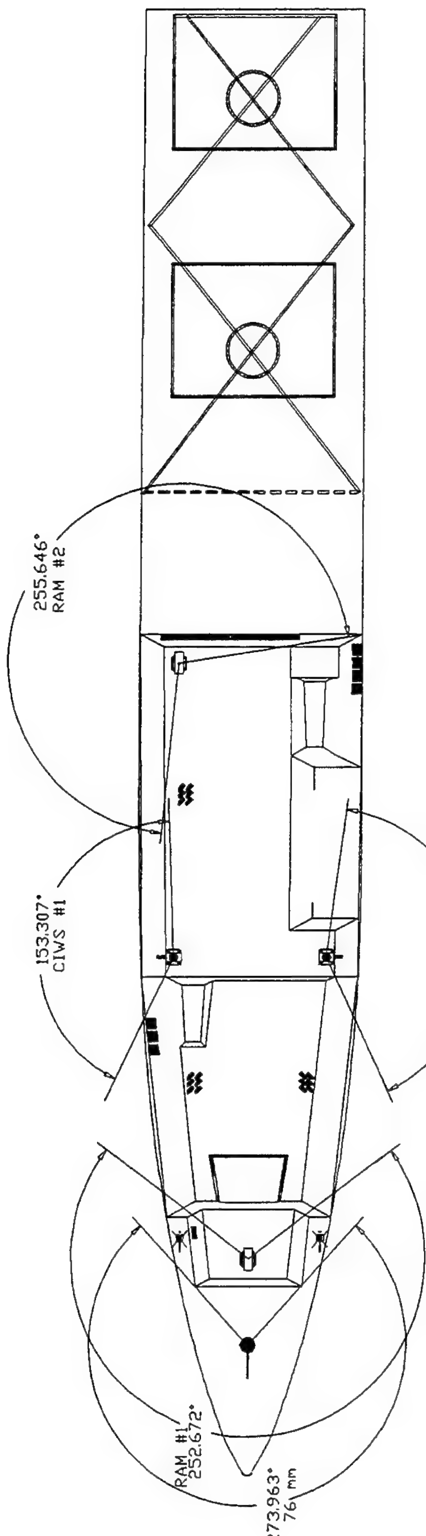


Figure 5-18. Arcs of Coverage (Engagement Elements)



Flag plot is located on the fourth deck forward of MMR1. The detailed layout of flag plot is similar to CIC, however the overall size is smaller and the required equipment to support the space is less.

A weapons/cargo elevator is located in the forward port corner of the hangar and runs from the main deck to the sixth deck. It will be used to carry weapons from the magazines as well as PTX modules from the module storage spaces. The ability to store PTX modules aboard the CMD provides for increased mission flexibility. Modules can be installed on the PTX craft to tailor them to provide a specific warfare area capability.

A module handling area is located on the second deck aft of CCS. An overhead crane is positioned above the well deck in the overhead of the second deck to lift modules and machinery from the berthed surface PTX platforms.

Vital combat systems spaces such as radio central, computer rooms, etc. are located within the superstructure to provide easy access from CIC and the bridge. These spaces are surrounded by non vital areas to increase survivability characteristics.

The bridge is located on the 04 level. A detailed layout of the bridge is provided in subsection F.

4. Well Deck (with PTX craft berthed) Arrangements

A schematic of the well deck with the surface PTX craft berthed is shown in figure 5-20. The second deck of the CMD will be provided with retractable accomodation ladders to facilitate personnel removal from the surface PTX craft while they are berthed. The well deck is equipped with retractable skids for mooring of the surface PTX craft.

5. Miscellaneous Arrangements

Other general arrangements are shown in figures 5-19 through 5-23. The locations of vital spaces and zones are shown in figure 5-24.

A. MESSING AND BERTHING

Crew berthing is located on the second deck outboard of the catwalk on both the port and starboard sides. The separation of these two spaces provides for male and female berthing assignments. The crew galley and mess decks are located on the main deck forward of the AIMD (Aircraft Intermediate Maintenace Detachment).

Officer and CPO (Chief Petty Officer) berthing is located on the 01 and 02 levels. These spaces are also separated to provide to male and female berthing assignments. The wardroom is located on the 01 level with prepared food provided by the crews galley.

Food service conveyors are installed in various locations to provide for easy loading and unloading of stores.

B. PROPULSION FUEL

All DFM tankage for the CMD and surface PTX craft is distributed on the sixth and seventh decks forward of MMR2. The total weight of DFM stored onboard the CMD is 4170 LT and occupies 175,100 cubic feet of volume. This quantity exceeds the required 3100 LT to maintain the endurance specified in the ORD. There is an unknown or unspecified amount of volume below the inner bottom in the bilge area, seventh deck aft of the PMRs and the sixth deck aft of the steering gear rooms.

C. AVIATION FUEL

All aviation fuel (JP-5) is located on the third, fourth and fifth decks aft in the wing walls. The total weight of JP-5 stored onboard the CMD is 1150 LT and occupies 48,500 cubic feet. The amount of JP-5 carried equates to approximately 120 sorties conducted by MH-53 aircraft.

D. BALLAST

Ballast tanks are distributed along the length of the ship on decks three through six. The total volume of ballast allocated to the CMD is 375,200 cubic feet which provides for 10,720 LT of weight. This quantity exceeds the minimum required of 8900 LT to obtain eight feet of water in the well deck at full load. The margin allows for boat operations in light load conditions.

E. OTHER TANKAGE

Lube oil and fuel oil service tanks are located in the respective machinery space in which they serve. Potable water tanks are located near the aft machinery rooms near the reverse osmosis generation units.

Figure 5-19. Sixth and Seventh Deck Arrangements

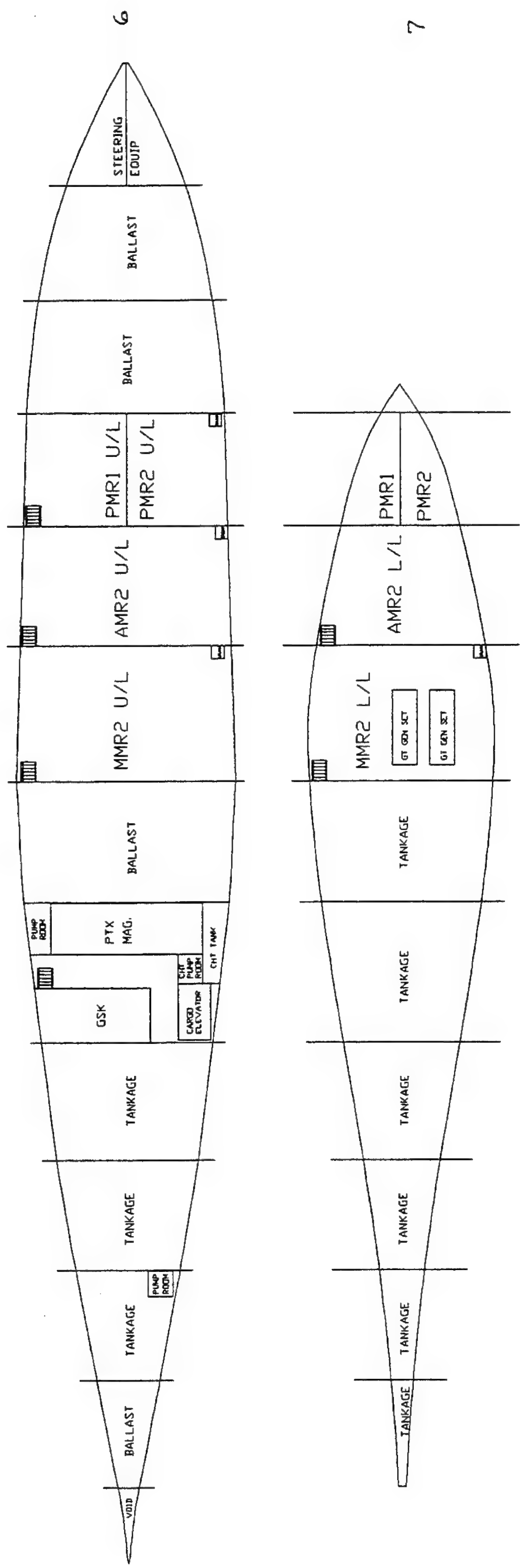


Figure 5-20. Fourth and Fifth Deck Arrangements

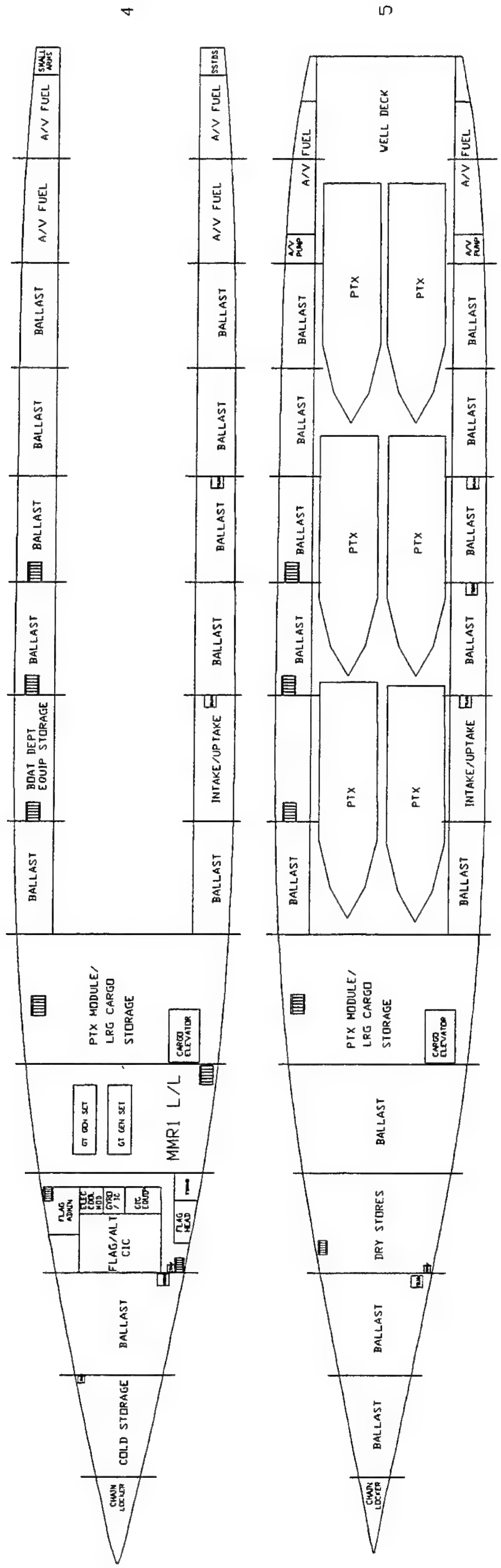


Figure 5-21. Second and Third Deck Arrangements

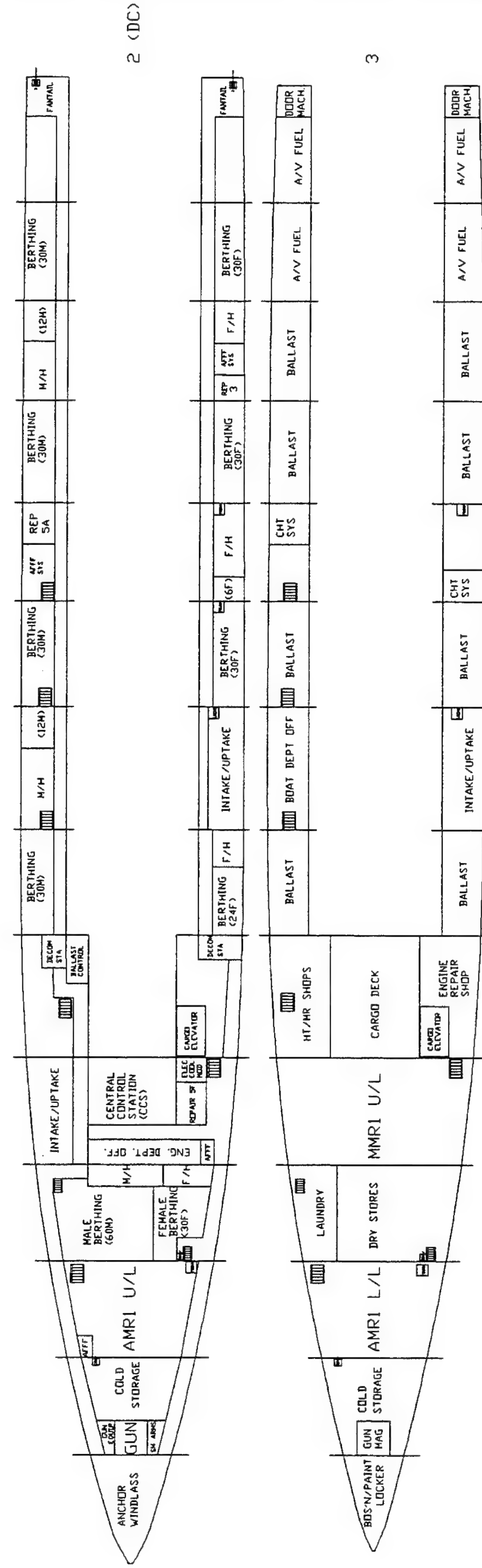


Figure 5-22. Main Deck and 01 Level Arrangements

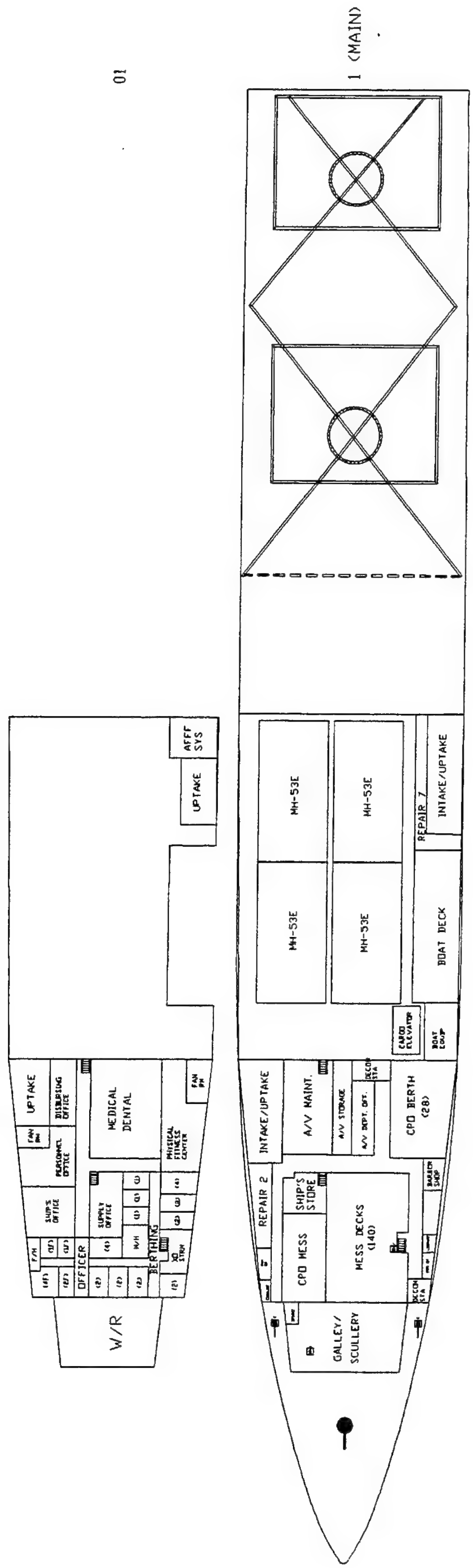


Figure 5-23. 02, 03 and 04 Level Arrangements

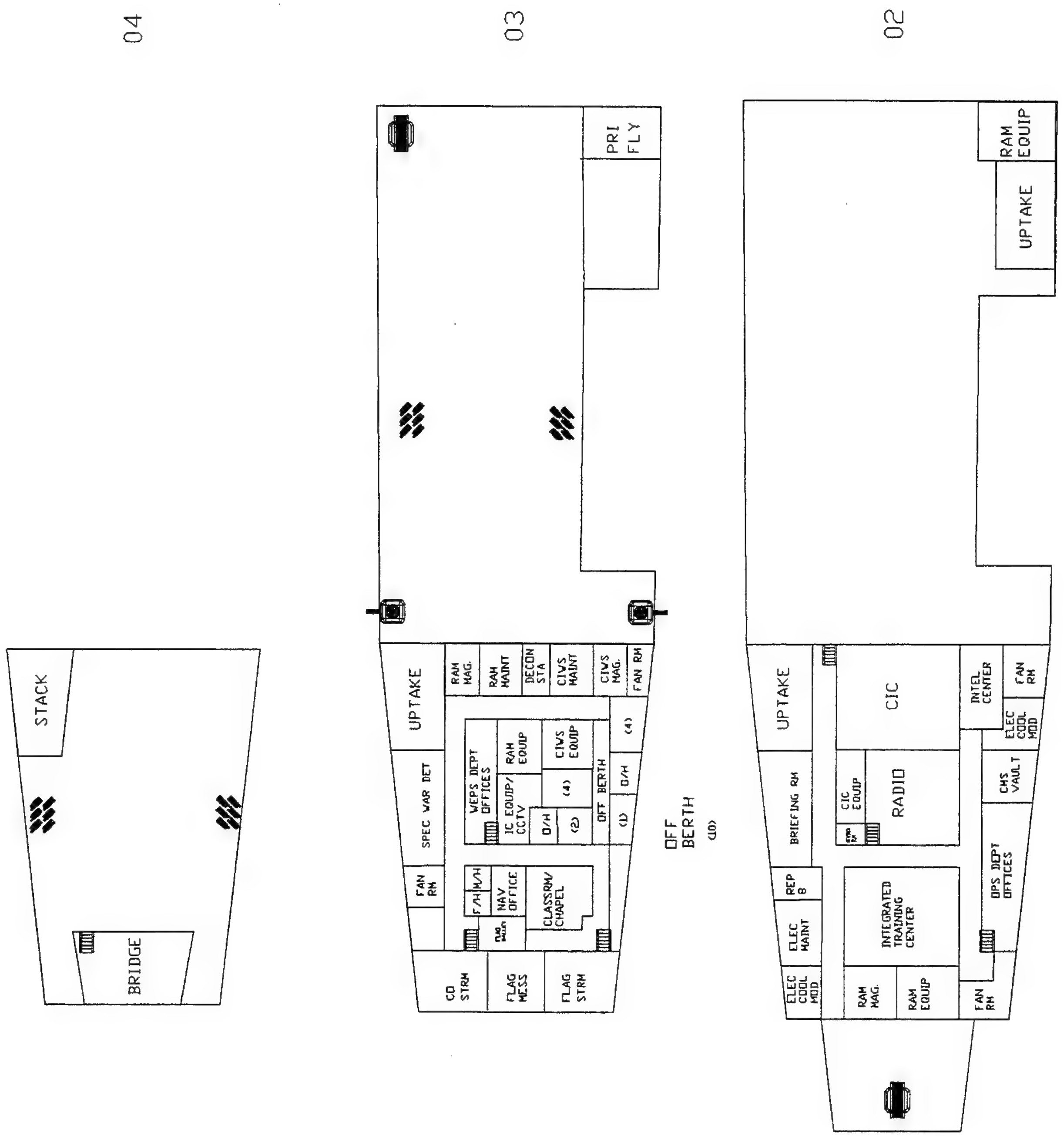
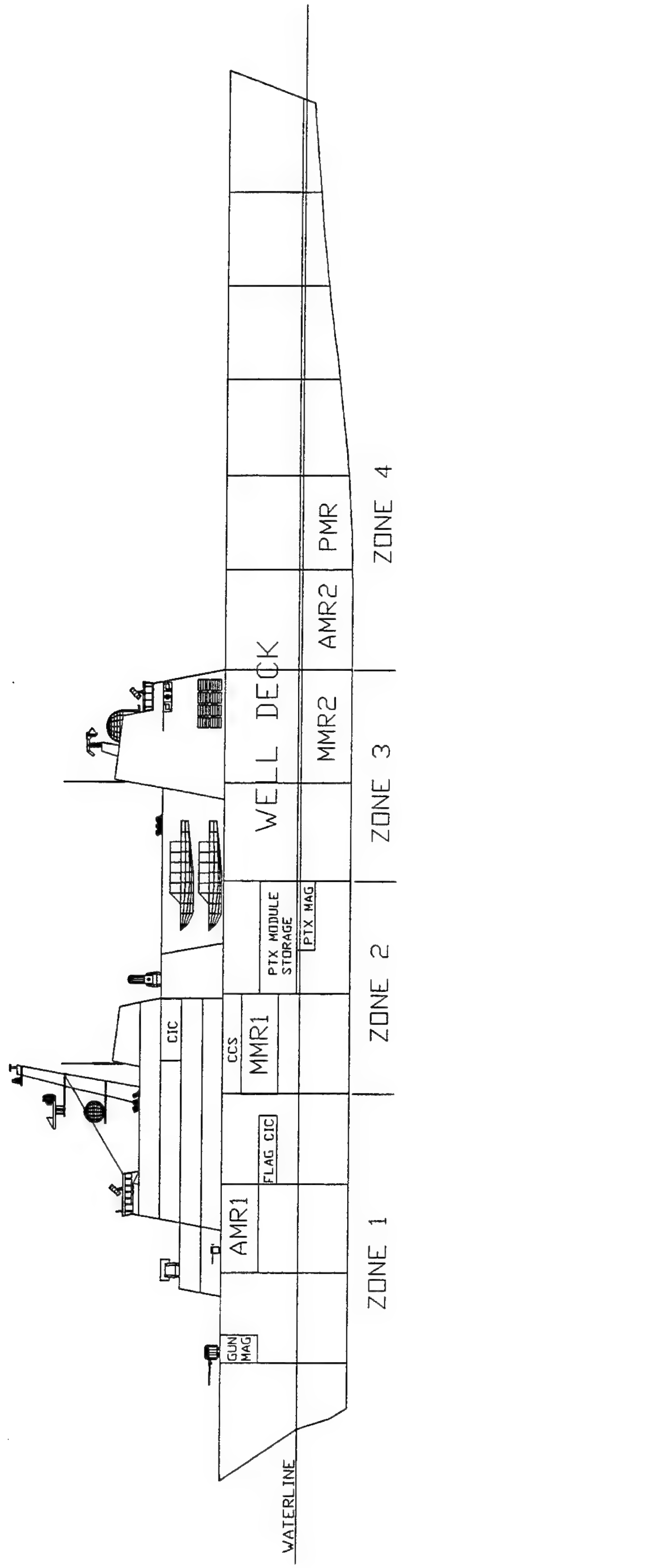


Figure 5-24. Vital Spaces and Zones



E. NAVAL ARCHITECTURE

The complete data file on the CMD is contained in Appendix G and the naval architecture tabulations are provided in Appendix H. Using Appendix H and the Genral HydroStatics (GHS) software, the major ship stability and control characteristics for the CMD are graphically displayed. The naval architecture drawings provided include: lines drawing, curves of form, section area curves, hydrostatic properties, floodable length curve, cross curves of stability, static stability curves, and bending moment curves. All hydrostatic analyses were performed on the hull offsets created by ASSET. Floodable length and bending moment curves used a modified hull form that included allowance for the well deck. There was a slight difference in the displacement for a given draft, as calculated by ASSET and GHS; therefore, the nominal full load draft was set to 23.2 ft and displacement of 19789 LT for all applicable analyses.

1. Lines Drawings

The CMD lines drawings and hull characteristics are shown in figure 5-25.

2. Curves of Form

The CMD curves of form are shown in figure 5-26.

3. Section Area Curves

The CMD section area curves for level trim at the DWL and for a variety of drafts are shown in figures 5-27 and 5-28.

4. Hydrostatic Properties at Level Trim

The CMD hydrostatic properties are shown in figure 5-29.

5. Floodable Length Curve

The CMD floodable length curve is shown in figure 5-30. It is used to determine the allowable compartments which will ensure that the margin line is not submerged should the compartments spanning the defined factor of subdivision become flooded. Regulations require U.S. Navy ships to sustain flooding damage up to 15 % of LWL, or

95 ft. for the CMD. Upon analysis of this requirement to the present locations of the bulkheads at general permeability levels of 0.7, 0.8, 0.9, it is observed that the floodable length is violated in the forward and aft portions of the ship. Therefore, further design iterations would require a detailed assesment of bulkhead locations and space permeabilities.

6. Cross Curves of Stability

The CMD Cross curves of stability are shown in figure 5-31. It provides a display of the ship's righting arm for various angles of heel over the range of likely displacements.

7. Static Stability Curves

The CMD static stability curve is shown in figure 5-32, the intact turning stability curve in figure 5-33 and the intact stability with wind effects is shown in figure 5-34. Review of figure 5-32 shows that the CMD reaches a maximum righting arm of 6.197 ft. at a heel of 50.67^{o} and an intact dynamic stability of 293.4 ft-deg. The CMD stability was evaluated for a high speed turn with a radius of 1000 yds. at 20 knots. The metacentric height is 9.19 ft. Figure 5-33 shows a turning heel angle of 6.2^{o} which is below the maximum allowed angle of 10^{o} for a new design hull. Additionally, the righting arm at the tuning heel is less than 60% of the maximum turming arm and the residual righting energy is not less than 40 % of the intact dynamic stability. Per DDS 079-1, to ensure all weather operation, the stability of the CMD was determined using a 100 knot wind. The resulting heel is 3.9^{o} with the associated righting arm less than 60 % of the maximum righting arm. The residual dynamic stability is greater than 140 % of the ship's rolling energy during a 25^{o} roll to windward. For both turning and wind effects, the CMD meets all requirements for static and dynamic stability.

8. Bending Moment Curves

The CMD bending moment curves with load distribution for level flotation, hogging and sagging conditions with a trochoidal wave are shown in figures 5-35 through 5-37 respectively.

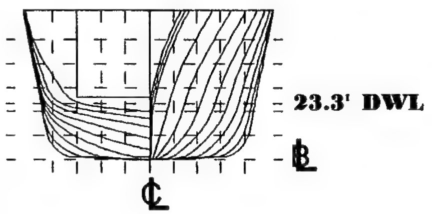
Figure 5-25. Lines Drawings

CMD PRINCIPLE CHARACTERISTICS

DWL = 23.3'   Lpp = 630'   B = 92'   DEPTH @ STA. 10 = 62'

Δ = 19790 LT Cb = .523   Cw = .783   Cp = .576   Cvp = .668

L/B = 6.97   L/D = 27.12   B/D = 3.89



31.5' STATION SPACING

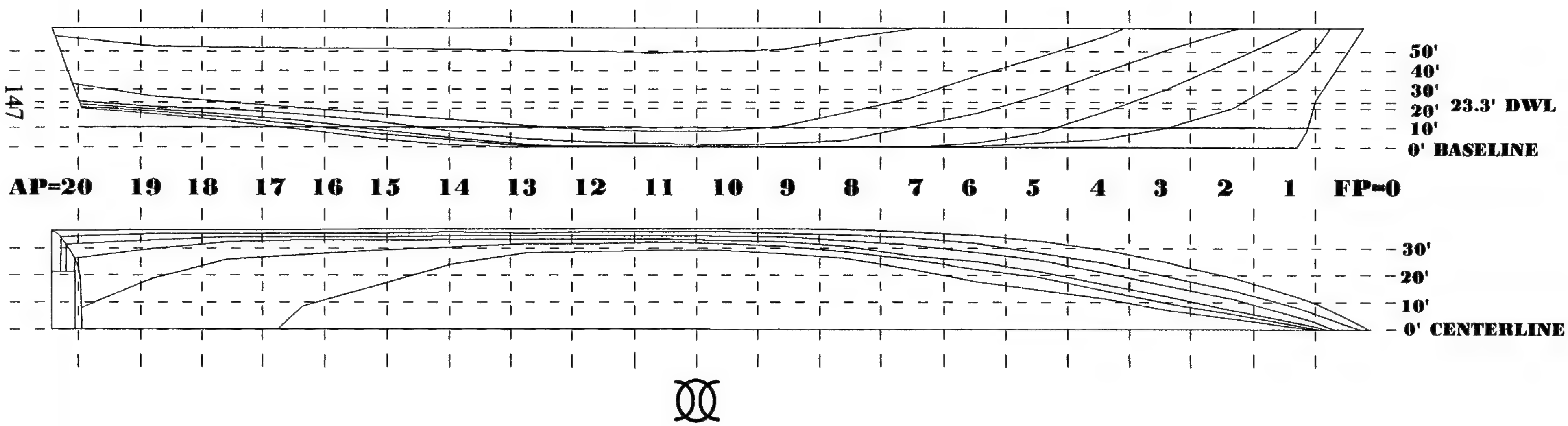


Figure 5-26. Curves of Form

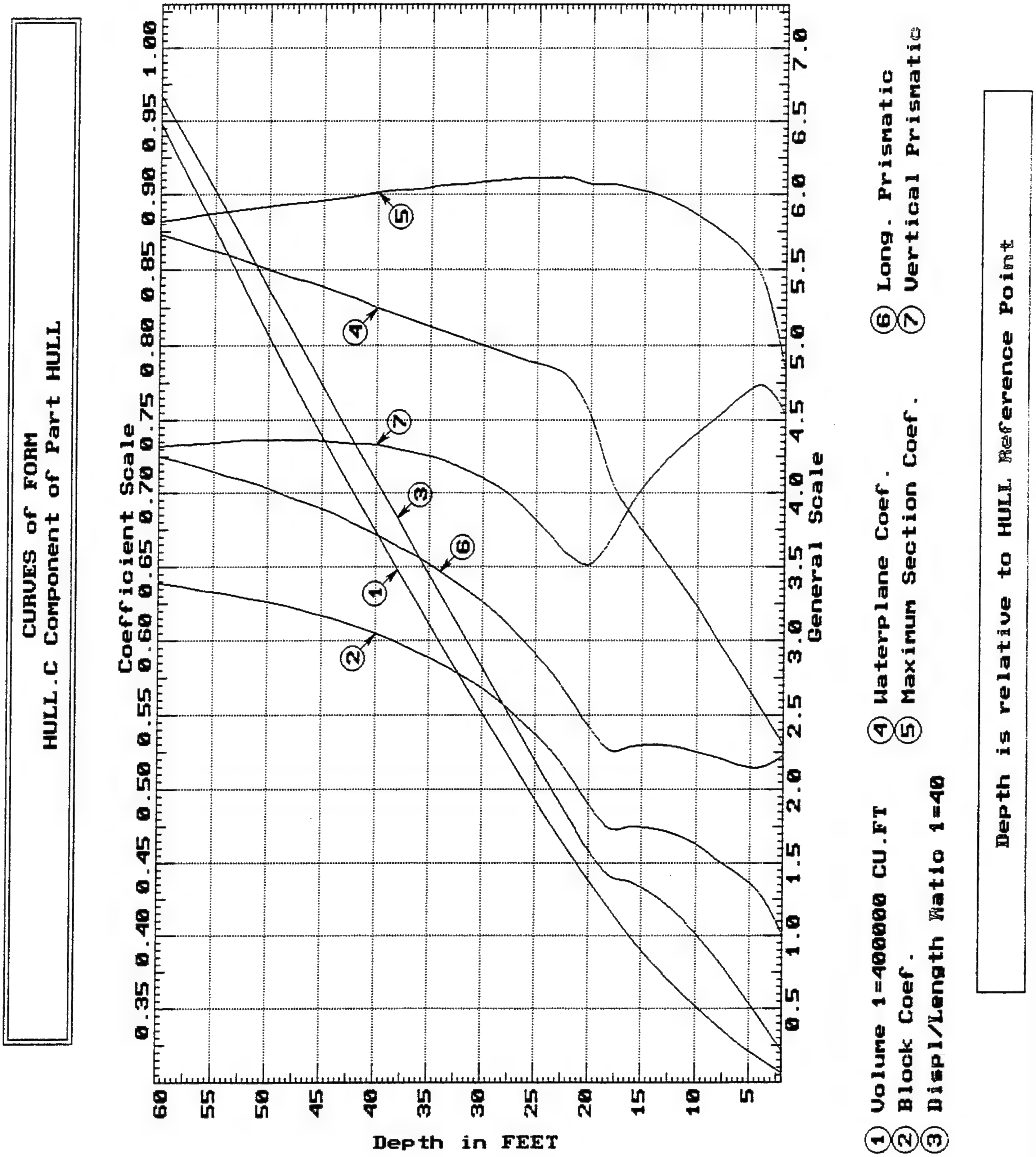
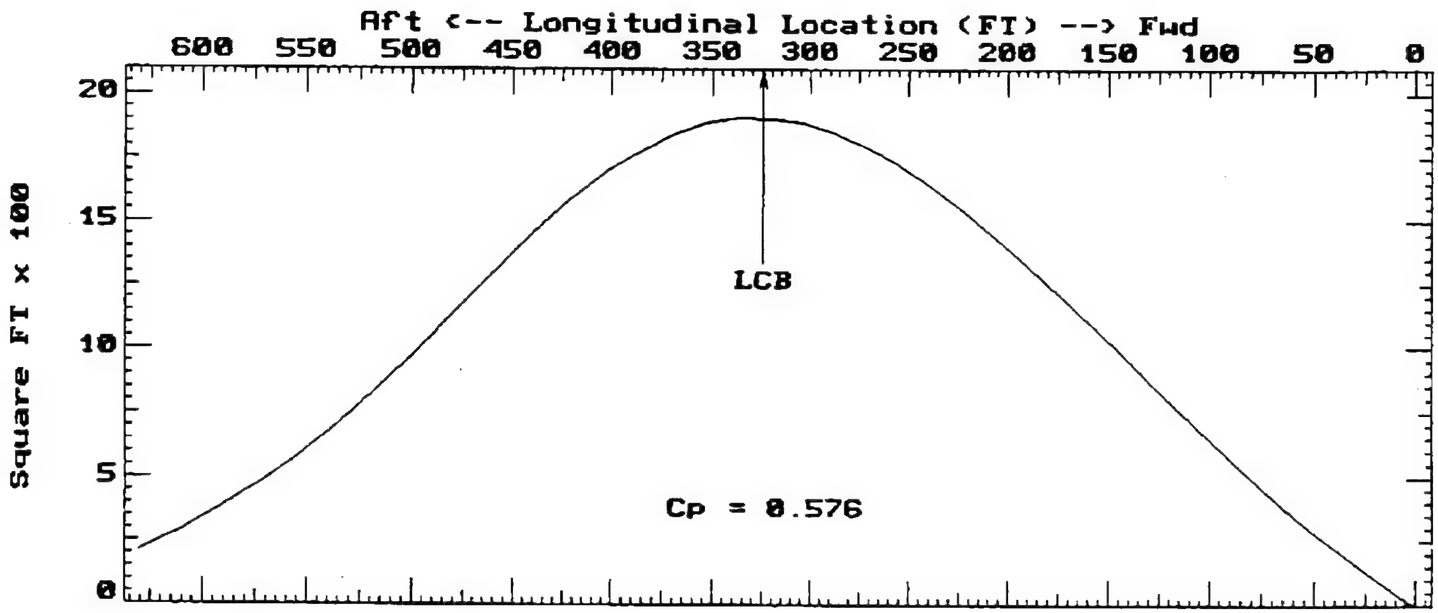


Figure 5-27. Section Area Curves

SECTION AREAS
LEVEL TRIM, NO HEEL

Part: HULL Component: HULL.C



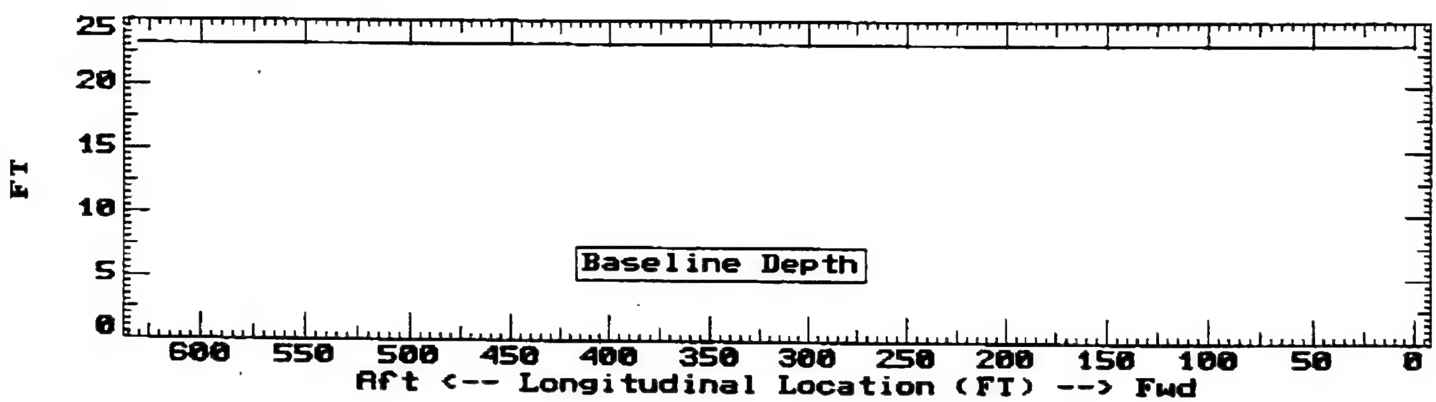


Figure 5-28. Section Area Curves

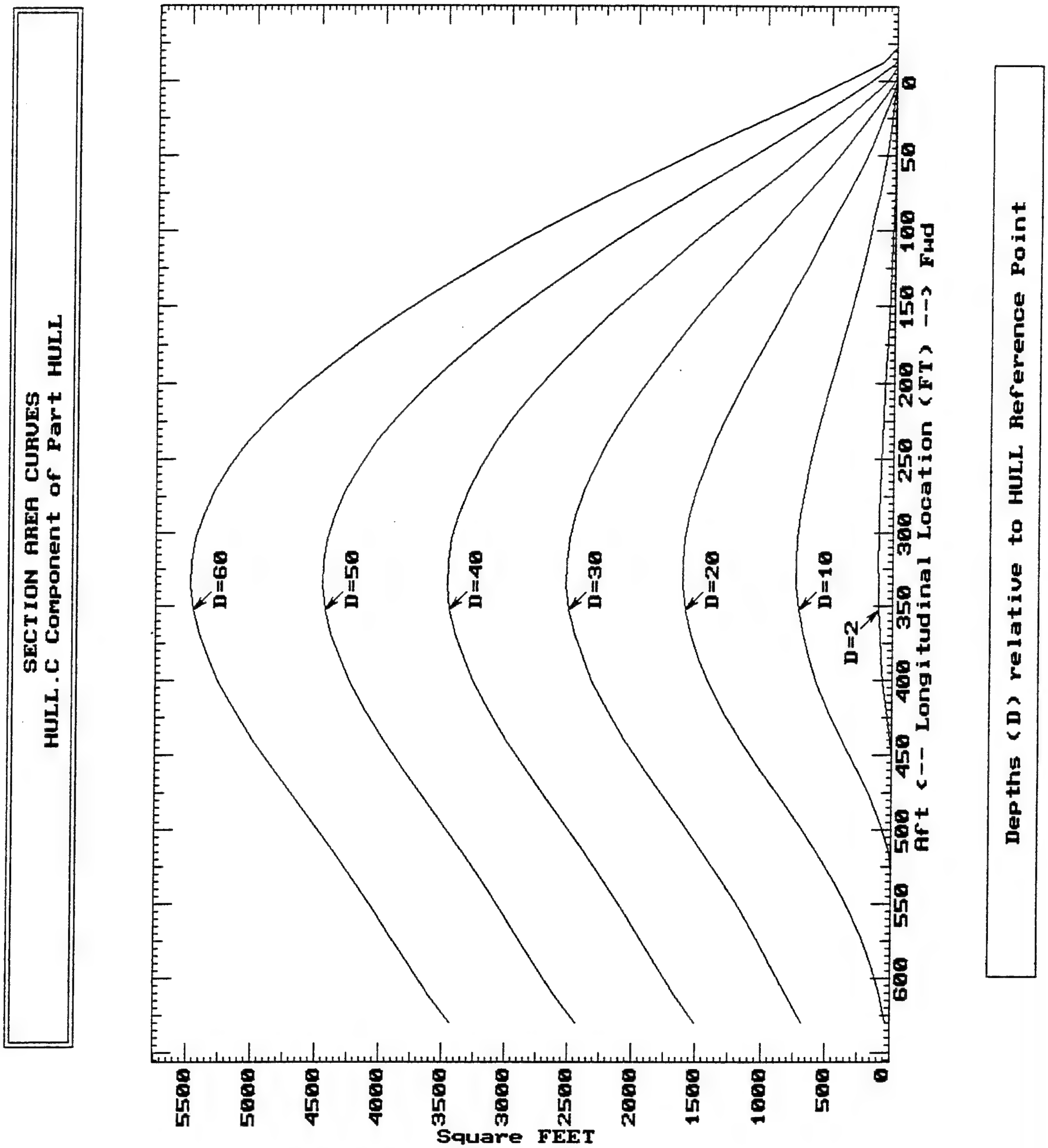


Figure 5-29. Hydrostatic Properties at Level Trim

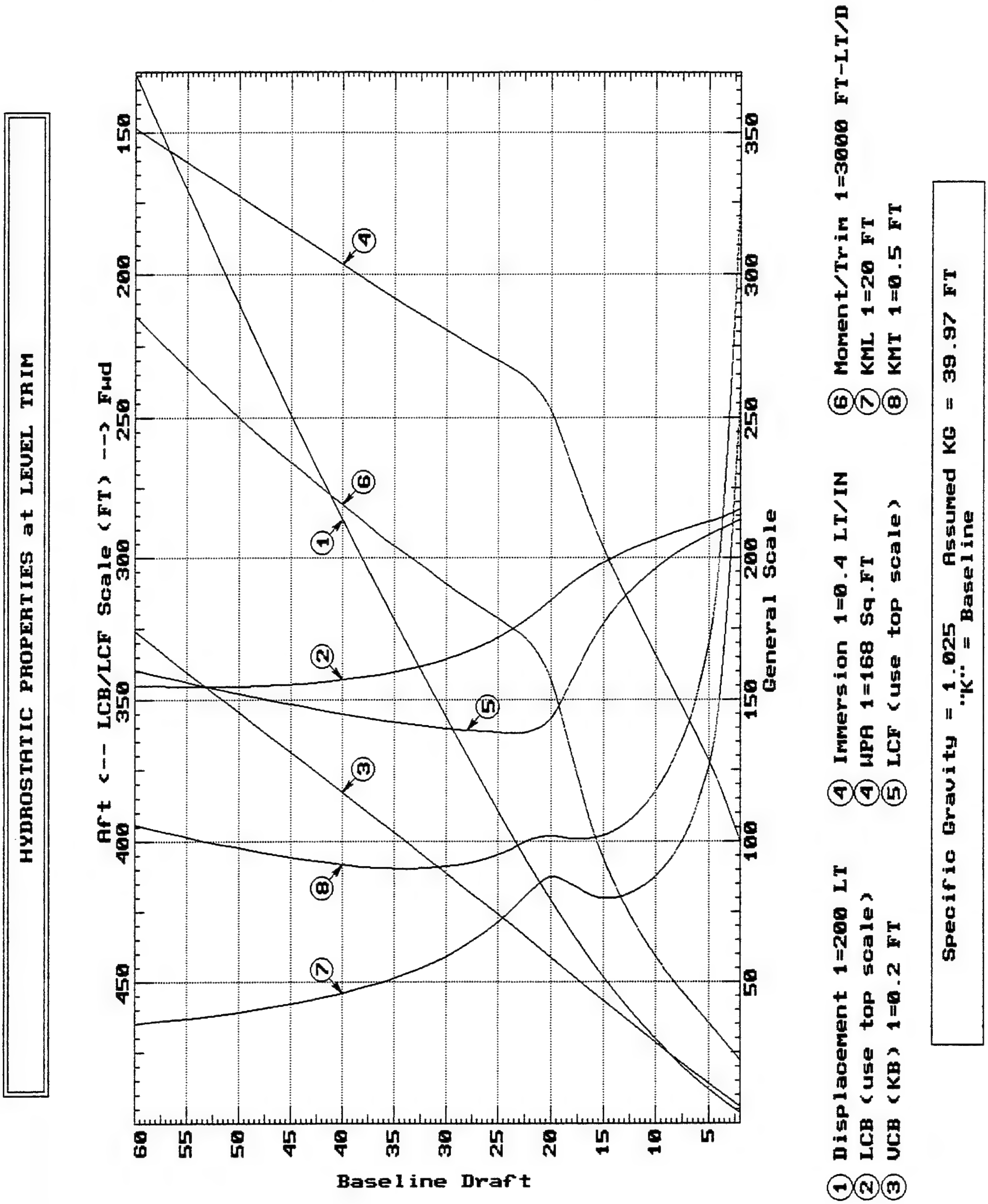


Figure 5-30. Floodable Length Curve

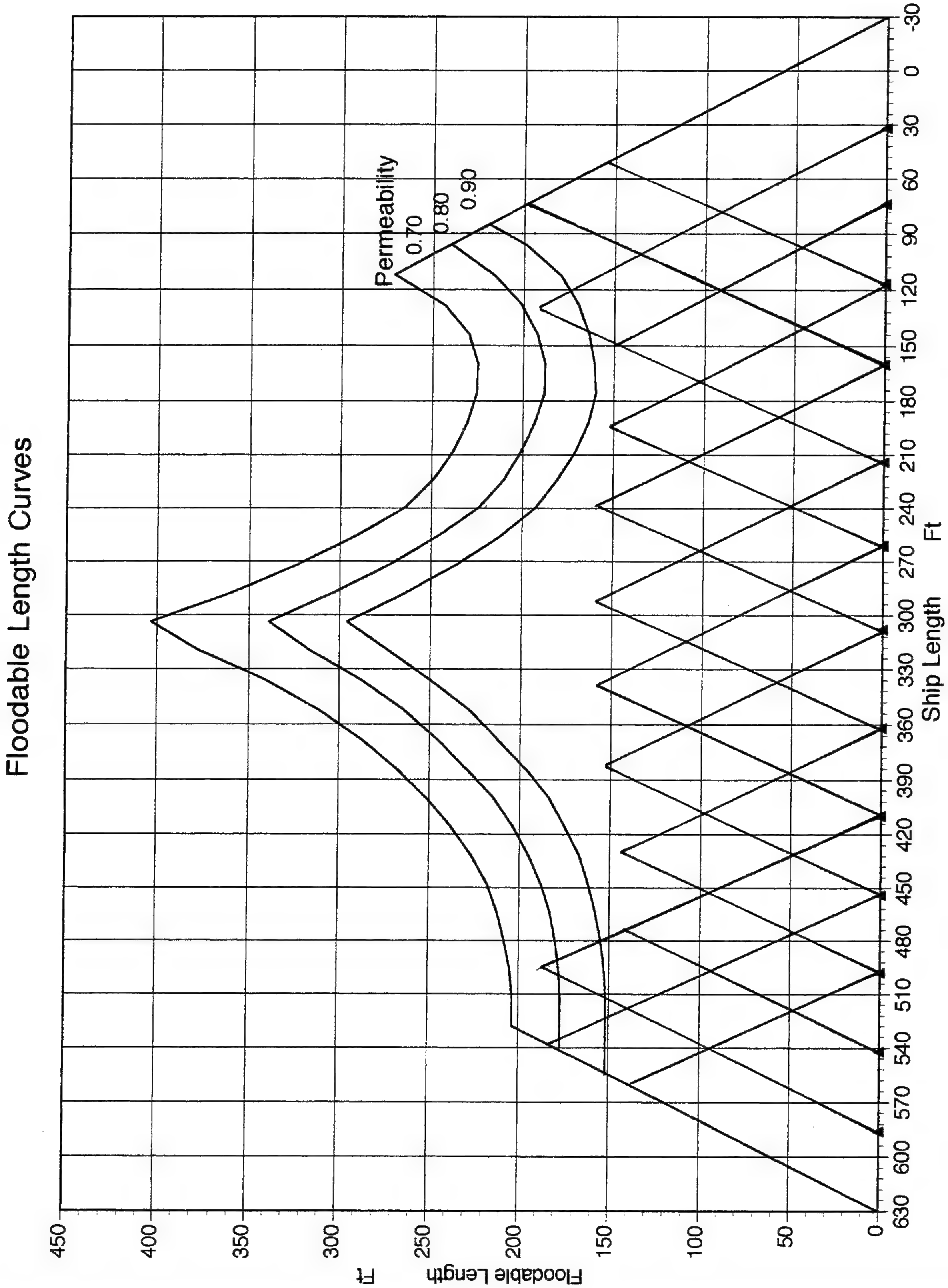


Figure 5-31. Cross Curves of Stability

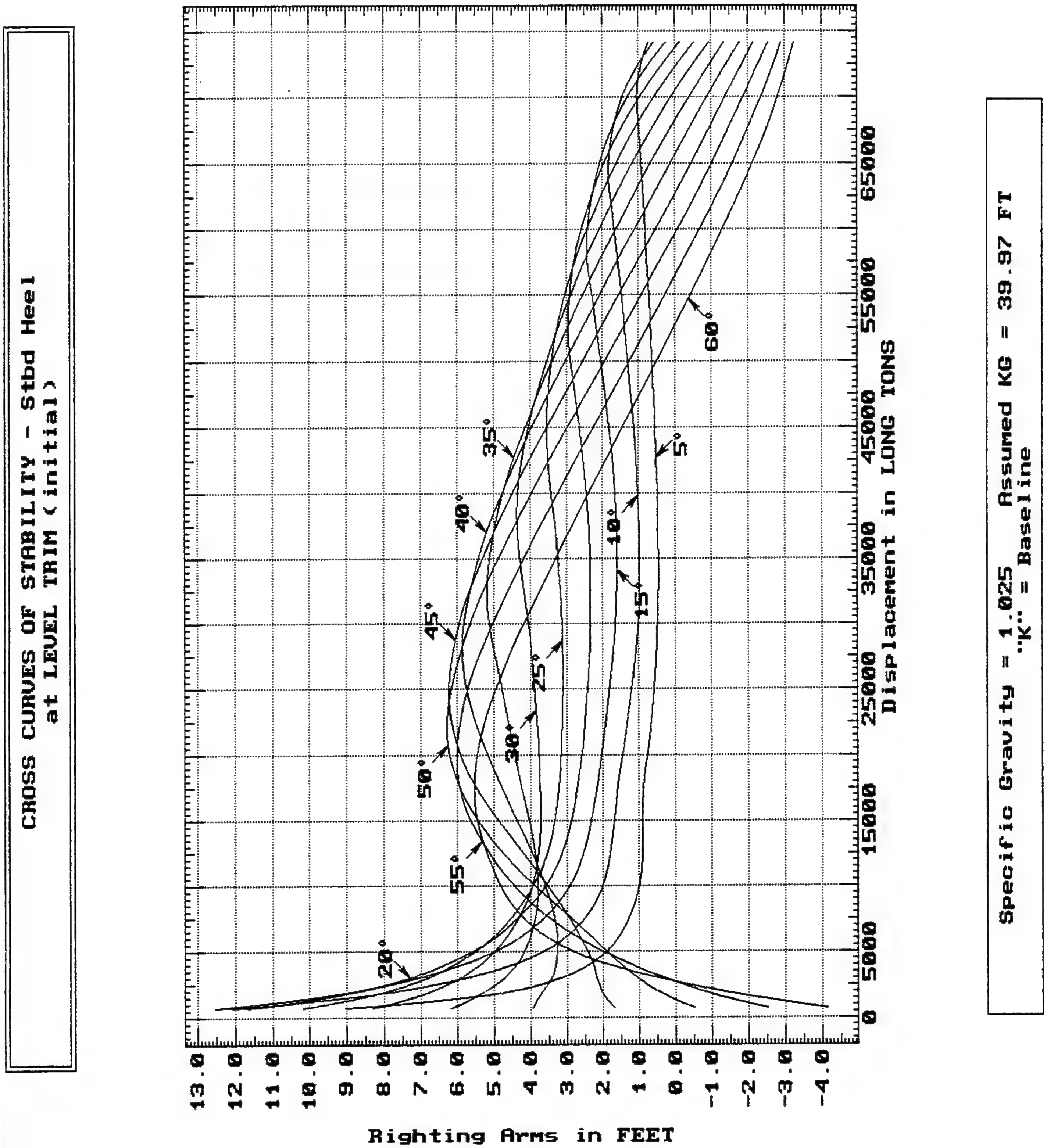


Figure 5-32. Static Stability Curve

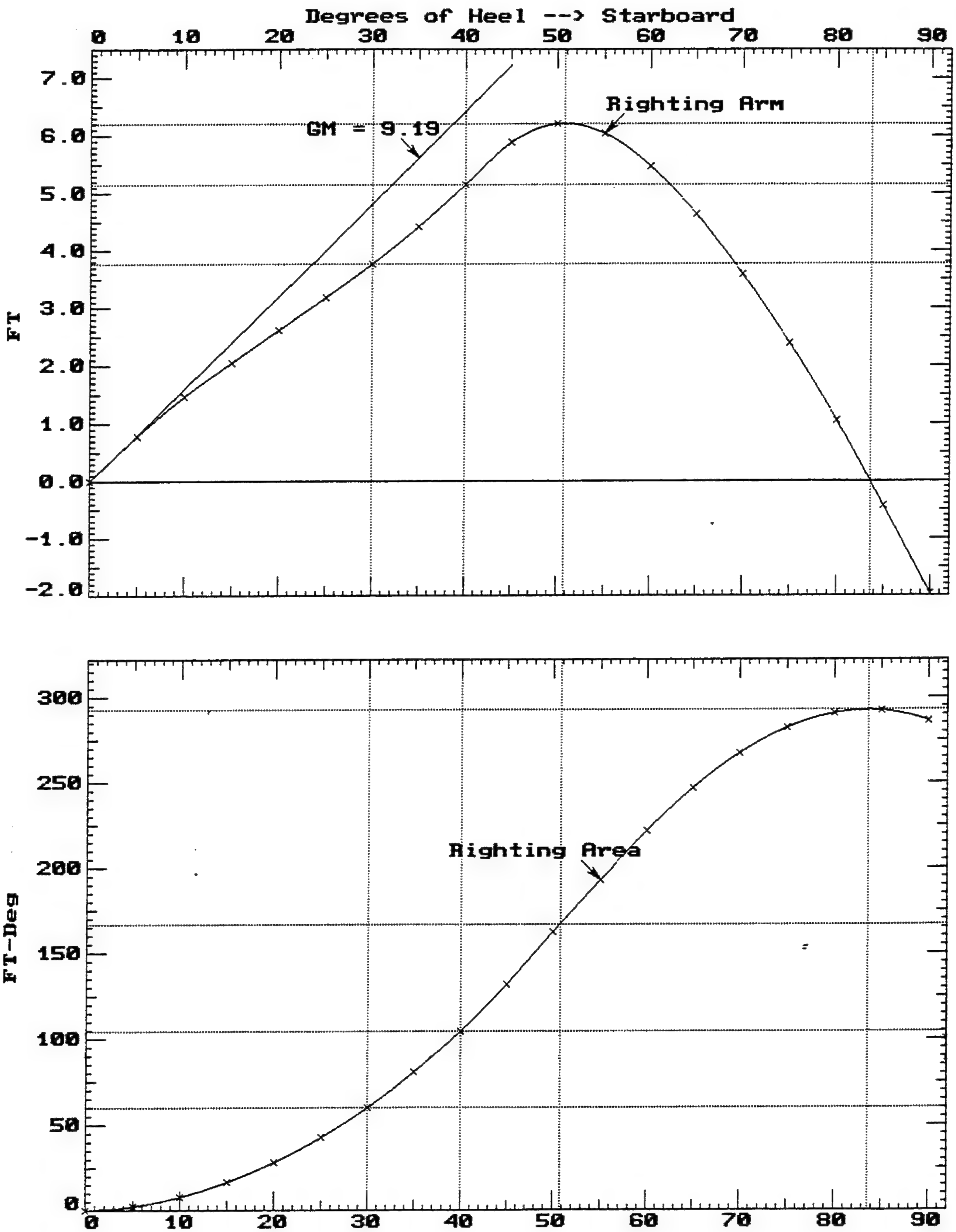


Figure 5-33. Intact Turning Stability Curve (No Wind)

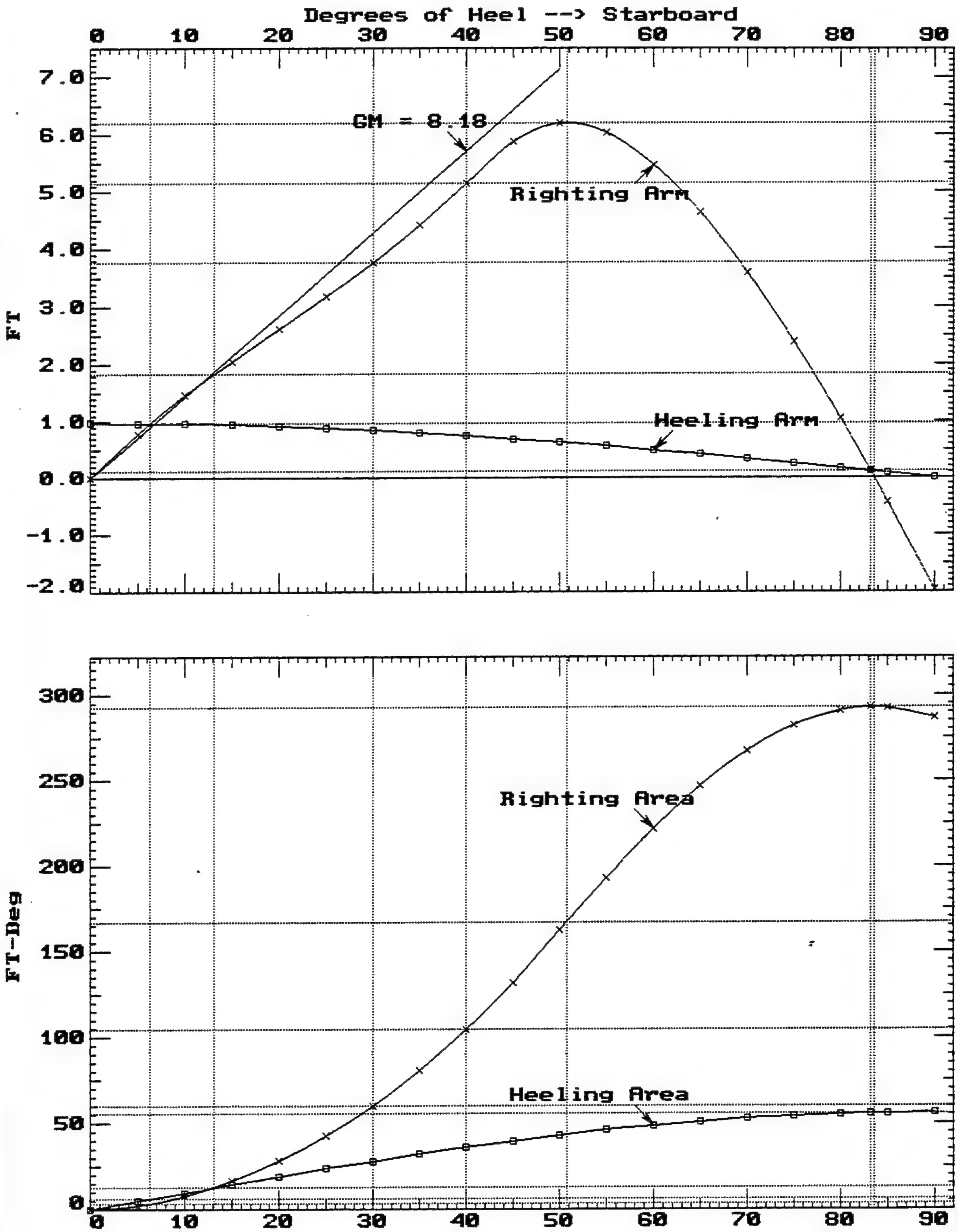


Figure 5-34. Intact Turning Stability Curve (Wind)

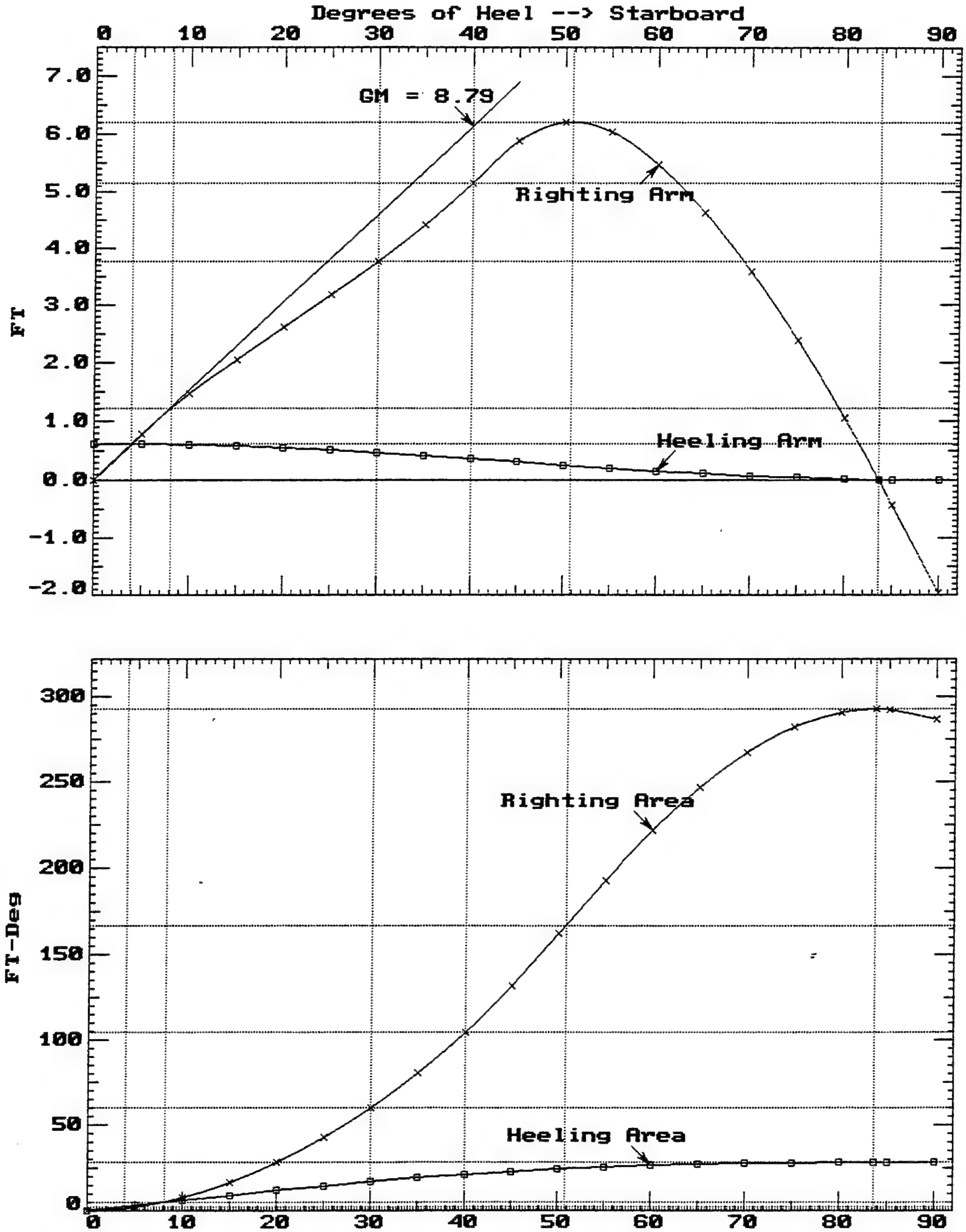


Figure 5-35. Bending Moment Curve (Level Trim)

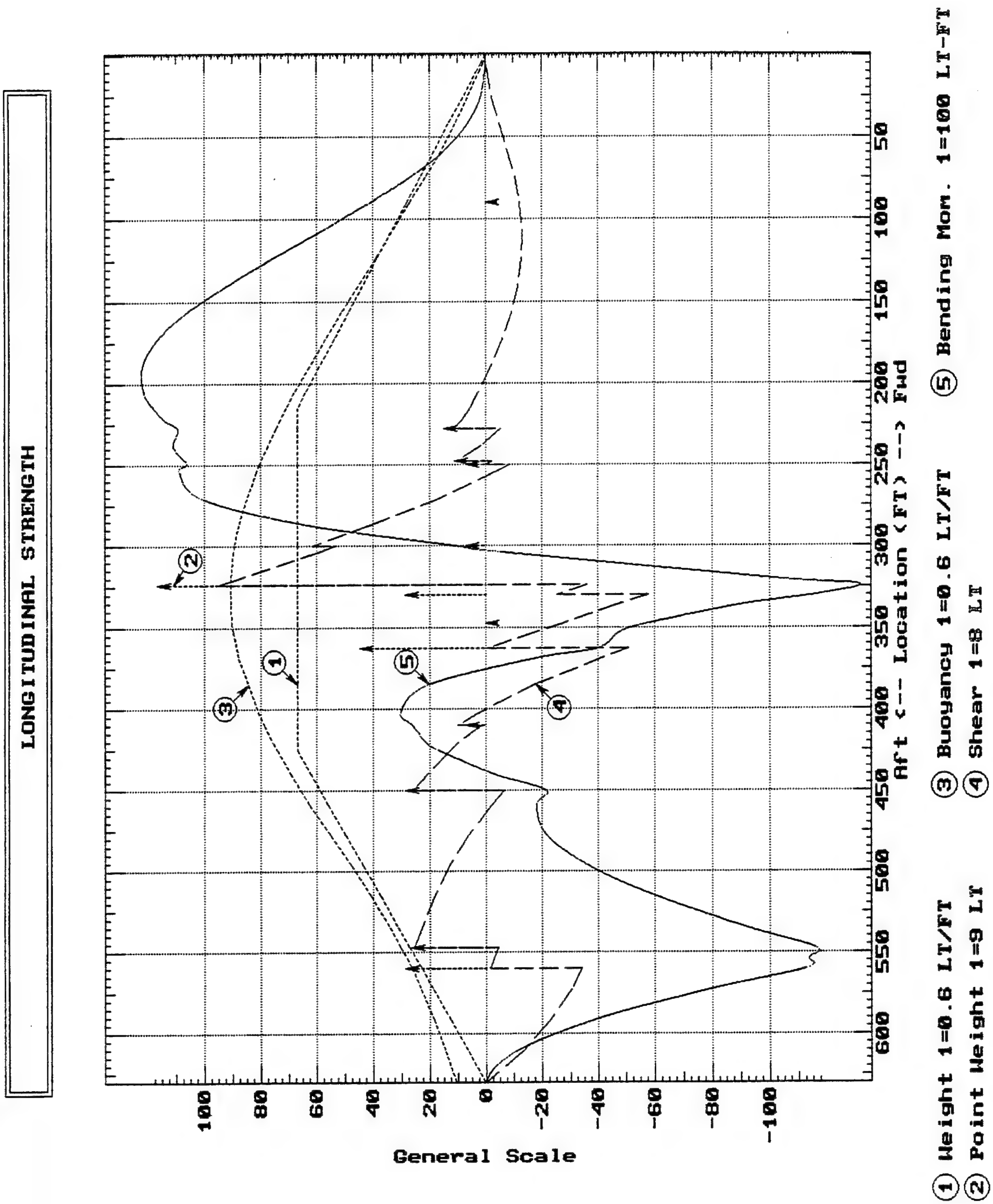


Figure 5-36. Bending Moment Curve (Hogging)

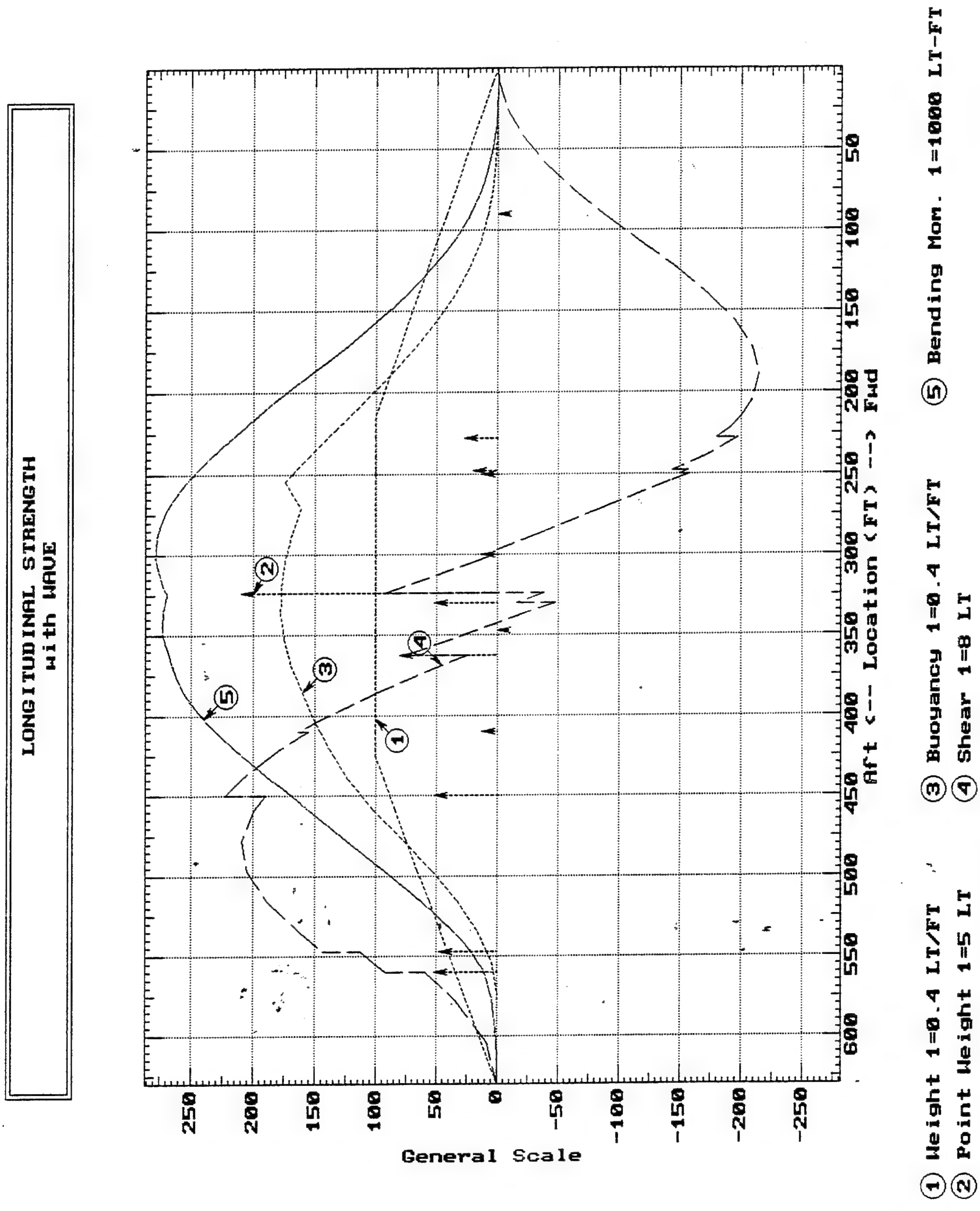
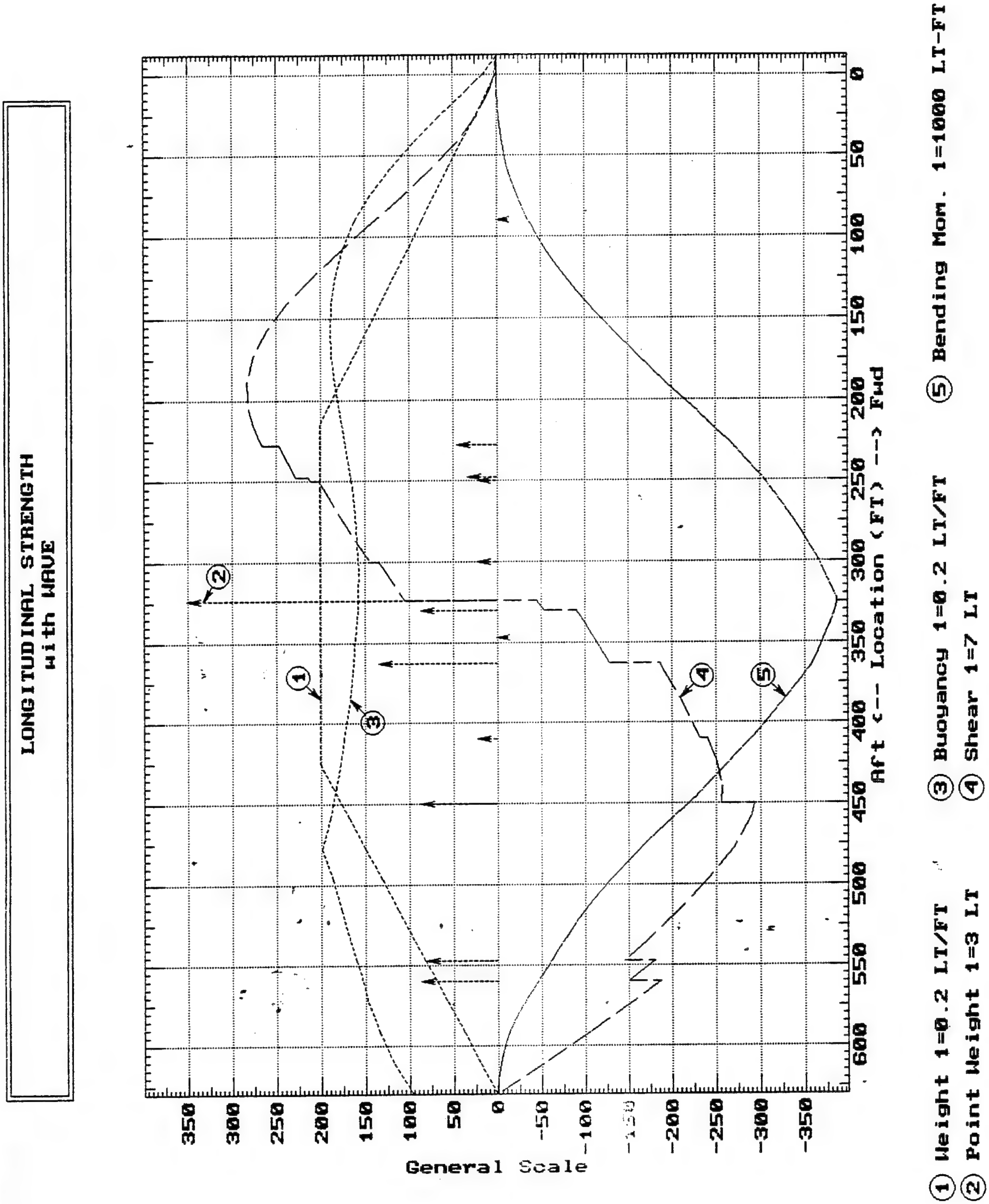


Figure 5-37. Bending Moment Curve (Sagging)



F. DETAILED DRAWINGS

Detailed drawings are generated for three of the mission control spaces: the bridge, Combat Information Center, and the Centrol Control Station, and three dimensional isometric views of the entire ship are provided.

1. Mission Control Spaces

A. BRIDGE

The detailed drawing for the bridge arrangements is shown in figure 5-38. The bridge contains the necessary ship control equipment to safely and comfortably navigate the CMD. The bridge has two radar repeaters one for the OOD/JOOD and one for the navigation team. The ship control console contains the equipment needed to operate both propulsion and steering controls. One gyro repeater is positioned on the bridge centerline and one on each bridge wing.

B. COMBAT INFORMATION CENTER (CIC)

CIC, figure 5-39, contains eight NTDS (Navy Tactical Data System) consoles, a large display panel consisting of three computer display screens which are controlled from two separate operating consoles, a radar operating console, an EW (Electronic Warfare) console and a navigation/dead reckoning plotting table. The space also contains the necessary control panels, radio handsets and computer consoles to support the needs of the space.

C. CENTRAL CONTROL STATION (CCS)

The CCS, figure 5-40, contains the necessary gage boards, damage control panels, communication gear and operating consoles to provide control of all propulsion machinery on the CMD. The CCS will act as damage control central in condition I.

2. Three Dimensional Views

Three dimensional views of the CMD are shown in figures 5-41 through 5-46.

Figure 5-38. Bridge Detail Drawing

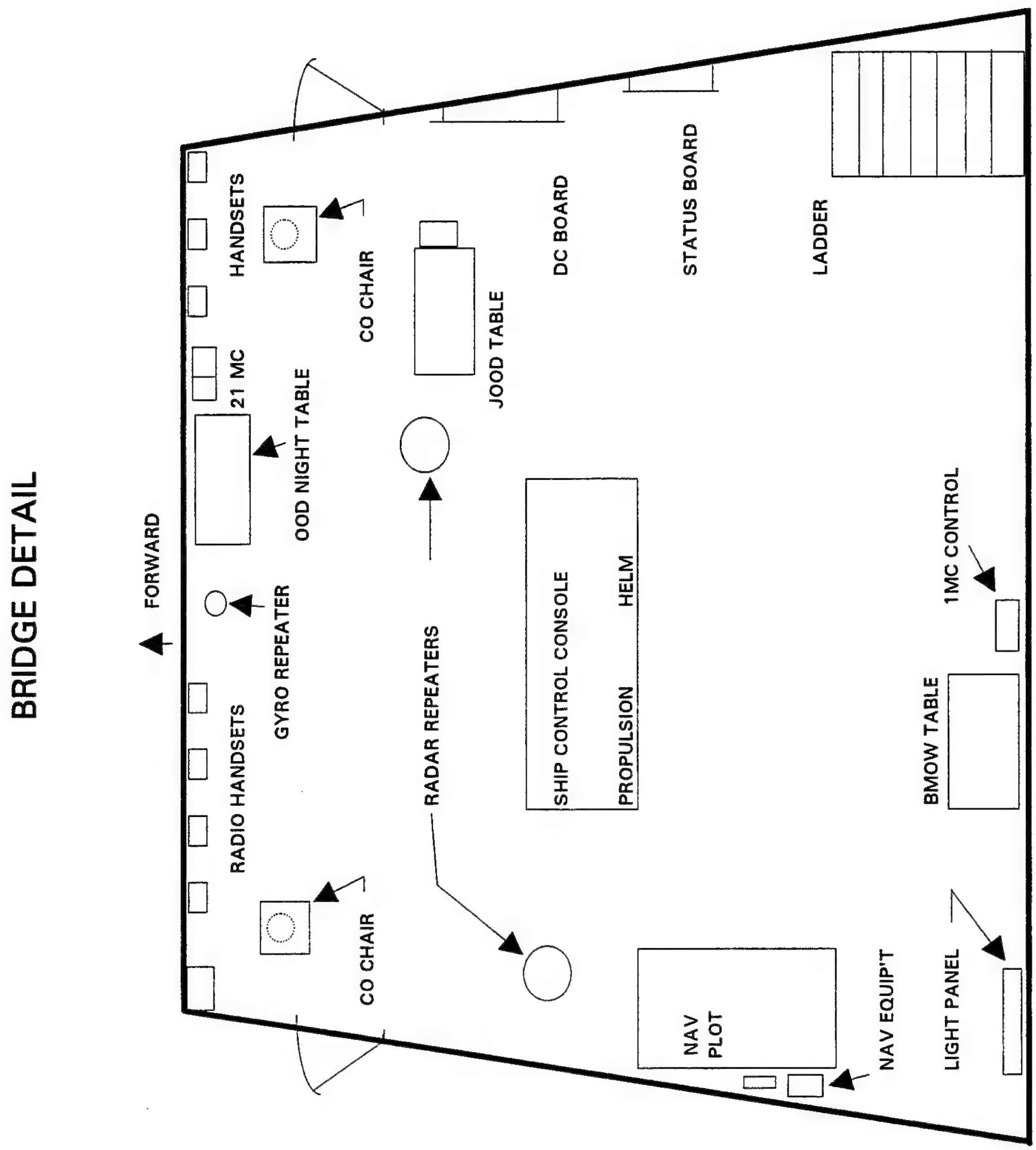


Figure 5-39. CIC Detail Drawing

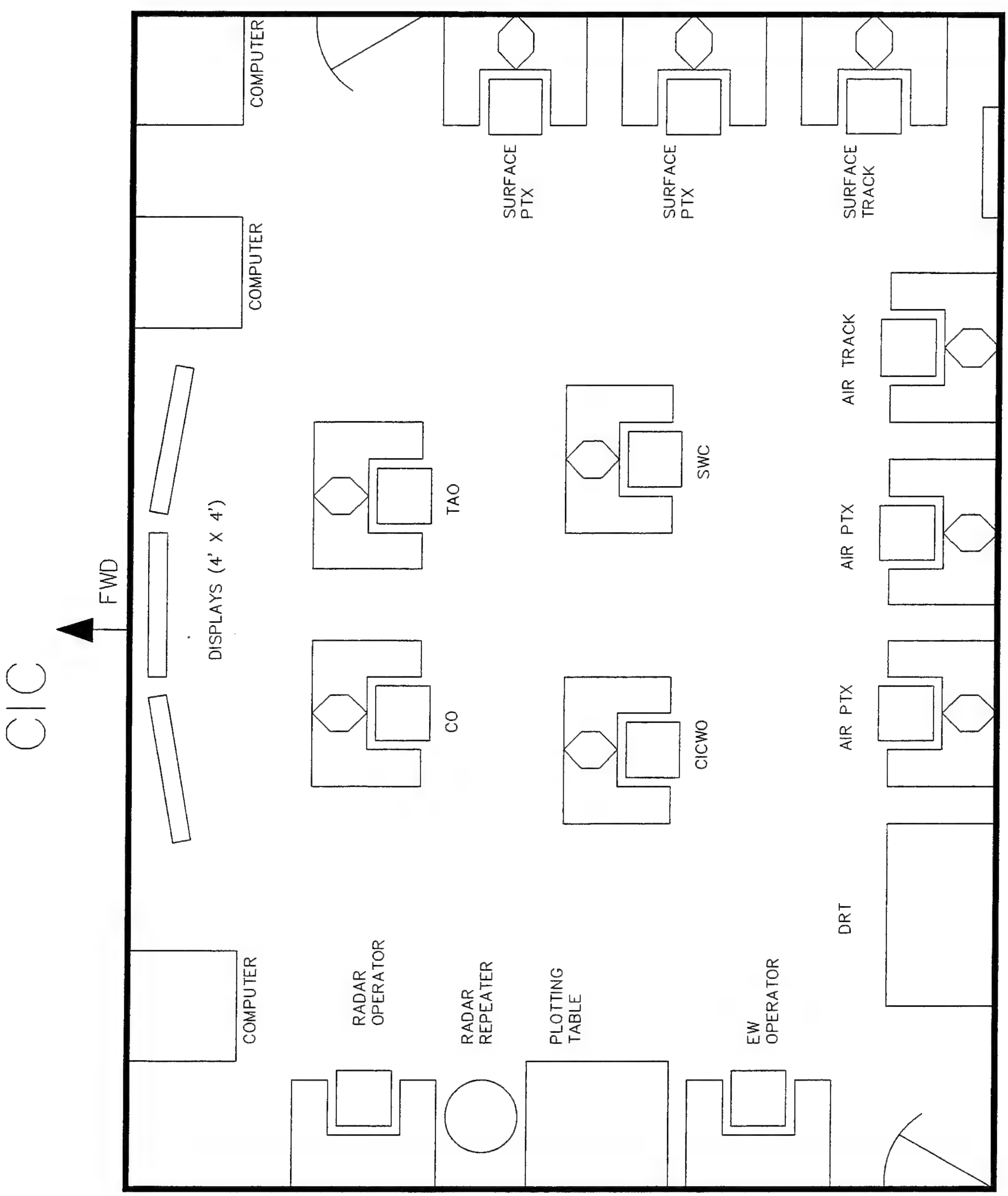


Figure 5-40. CCS Detail Drawing

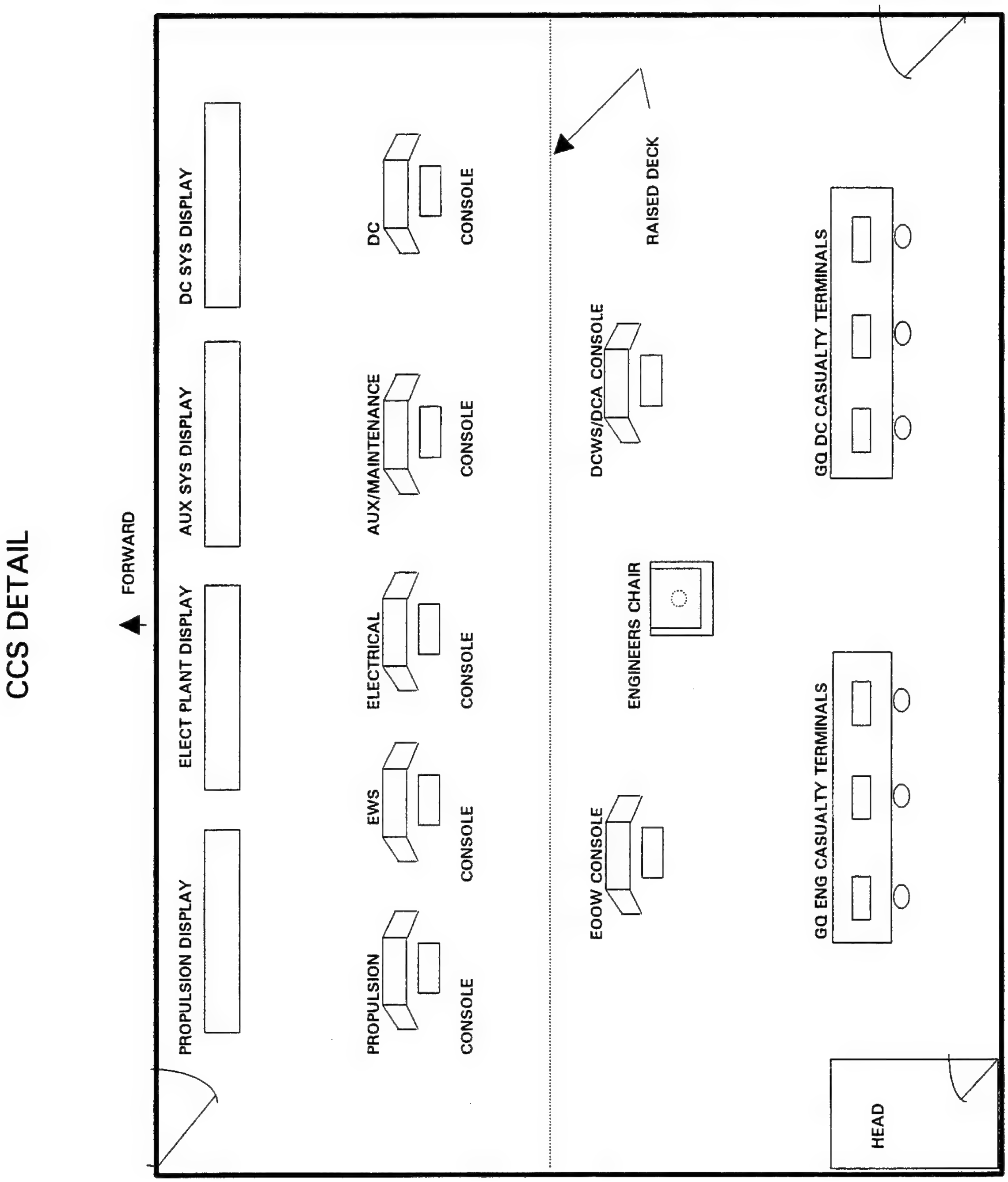


Figure 5-41. Port Bow View

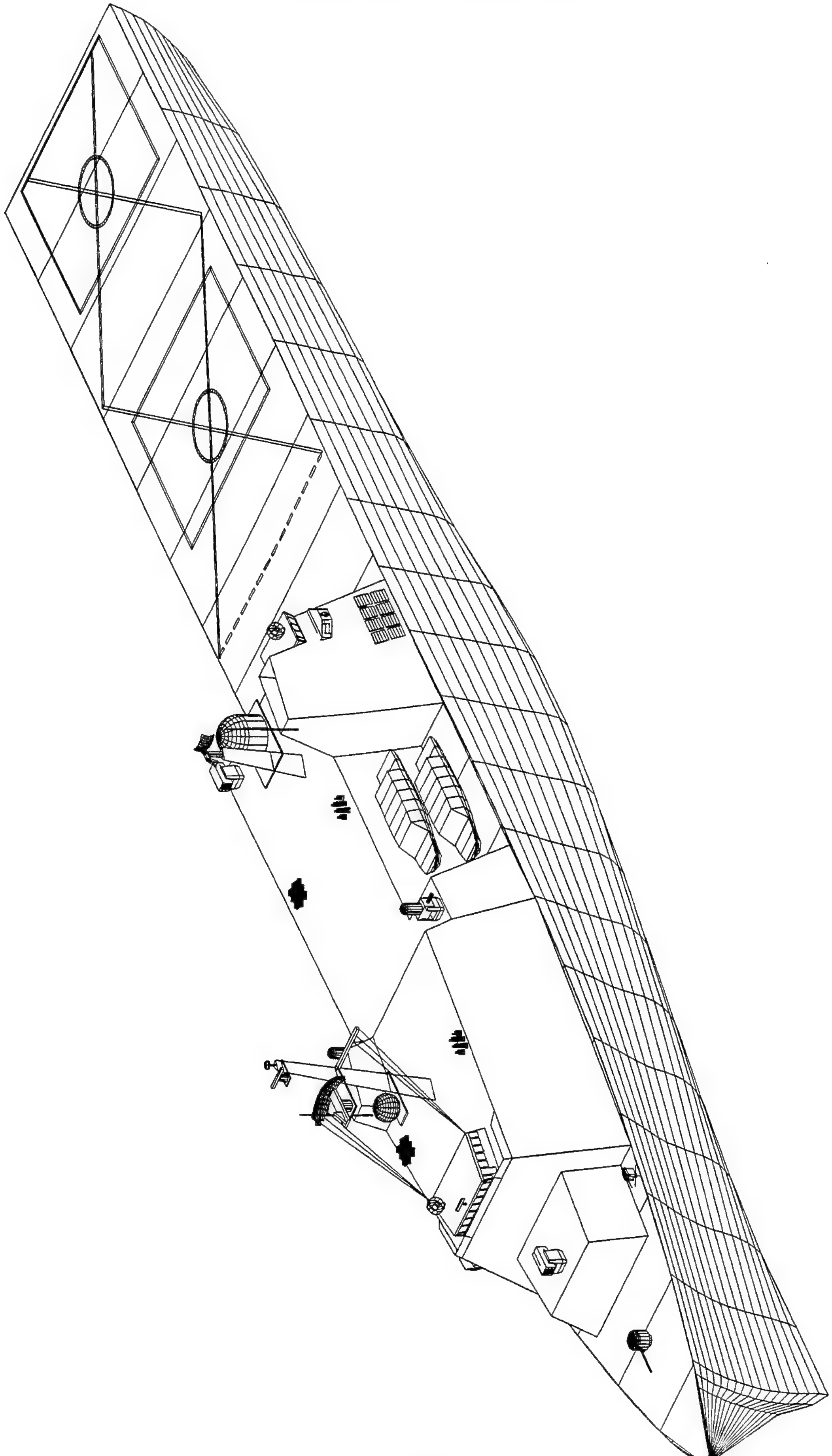


Figure 5-42. Port Quarter View

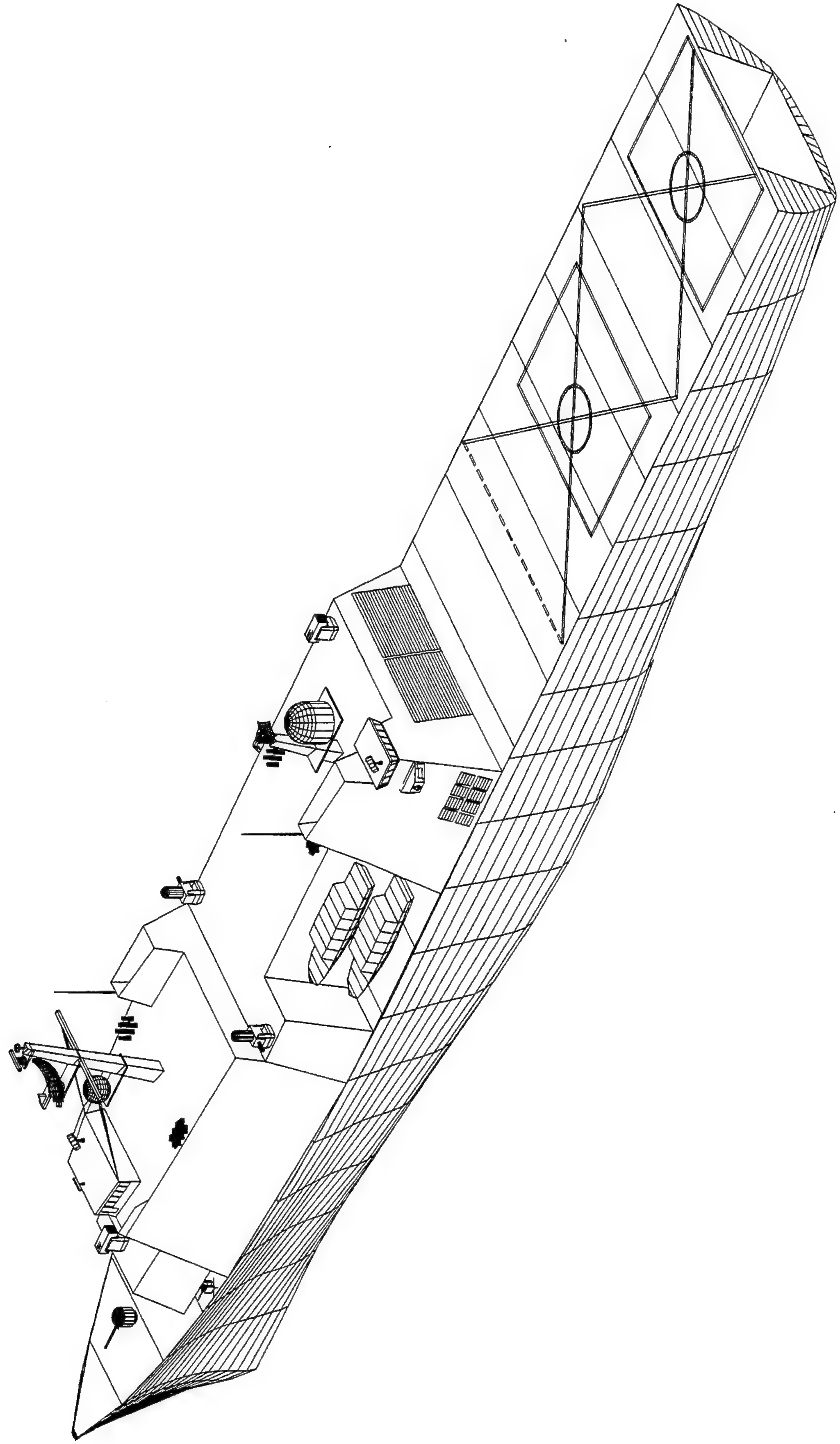


Figure 5-43. Starboard Bow View

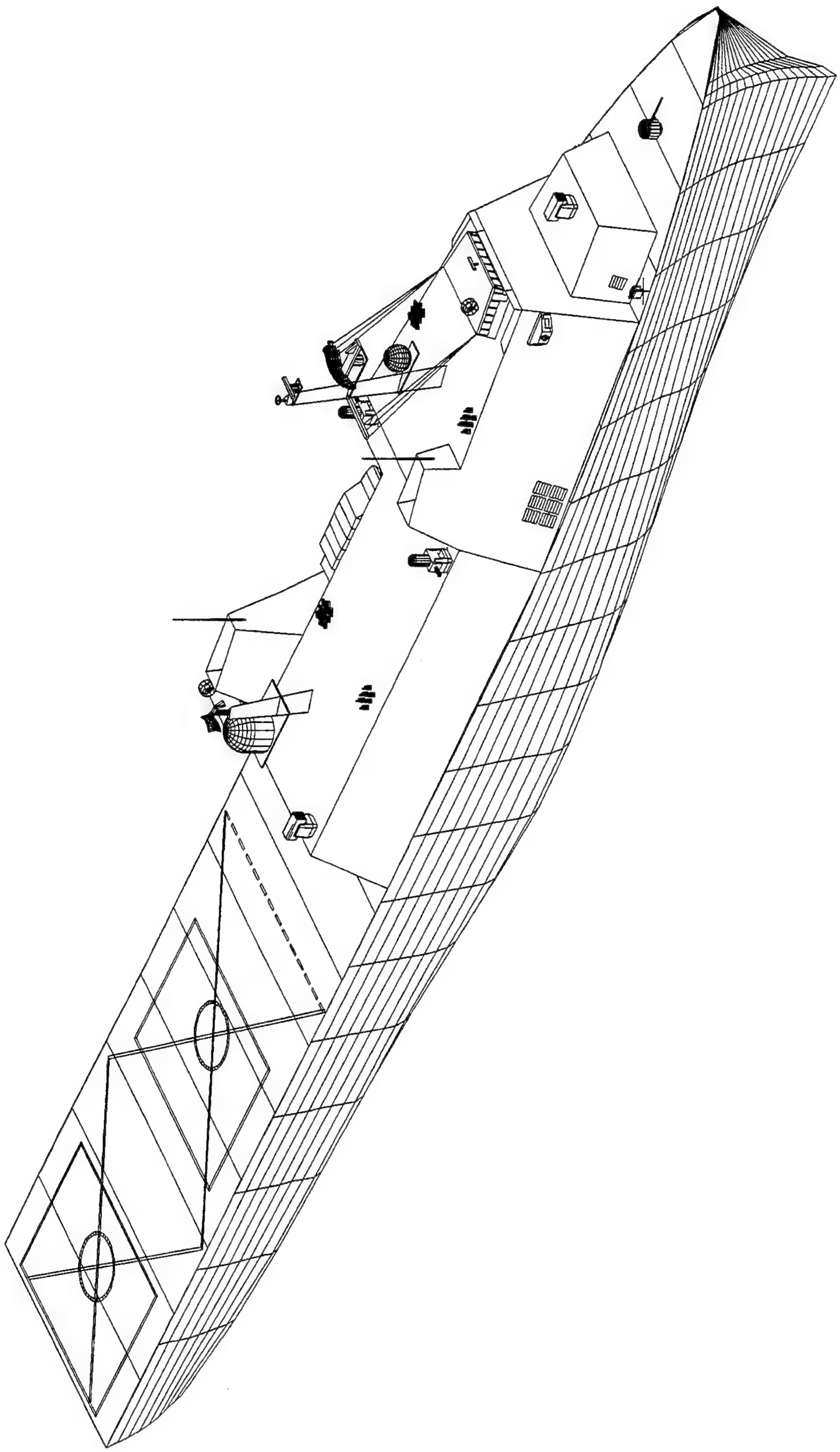


Figure 5-44. Starboard Quarter View

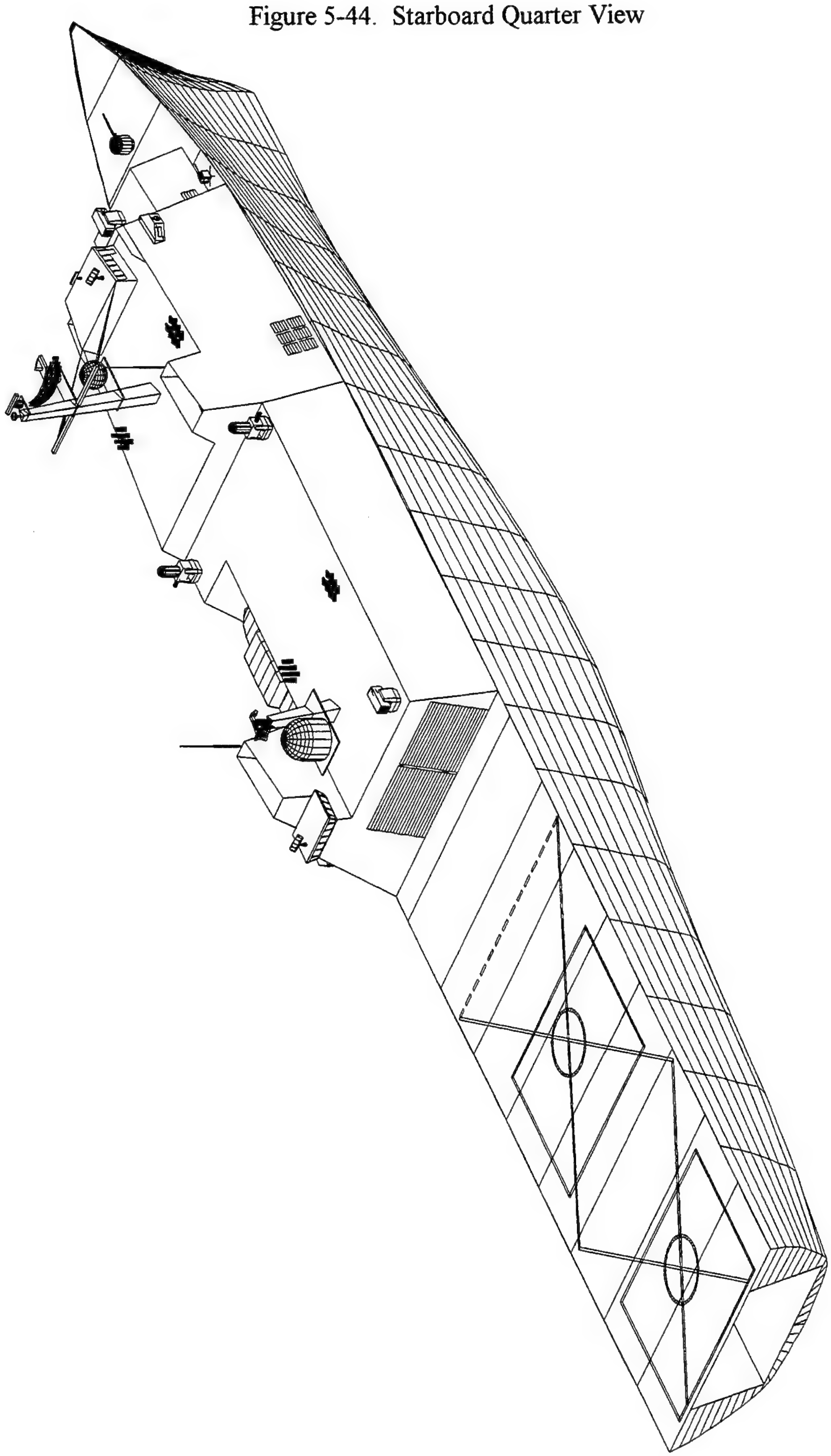


Figure 5-45. Bow View

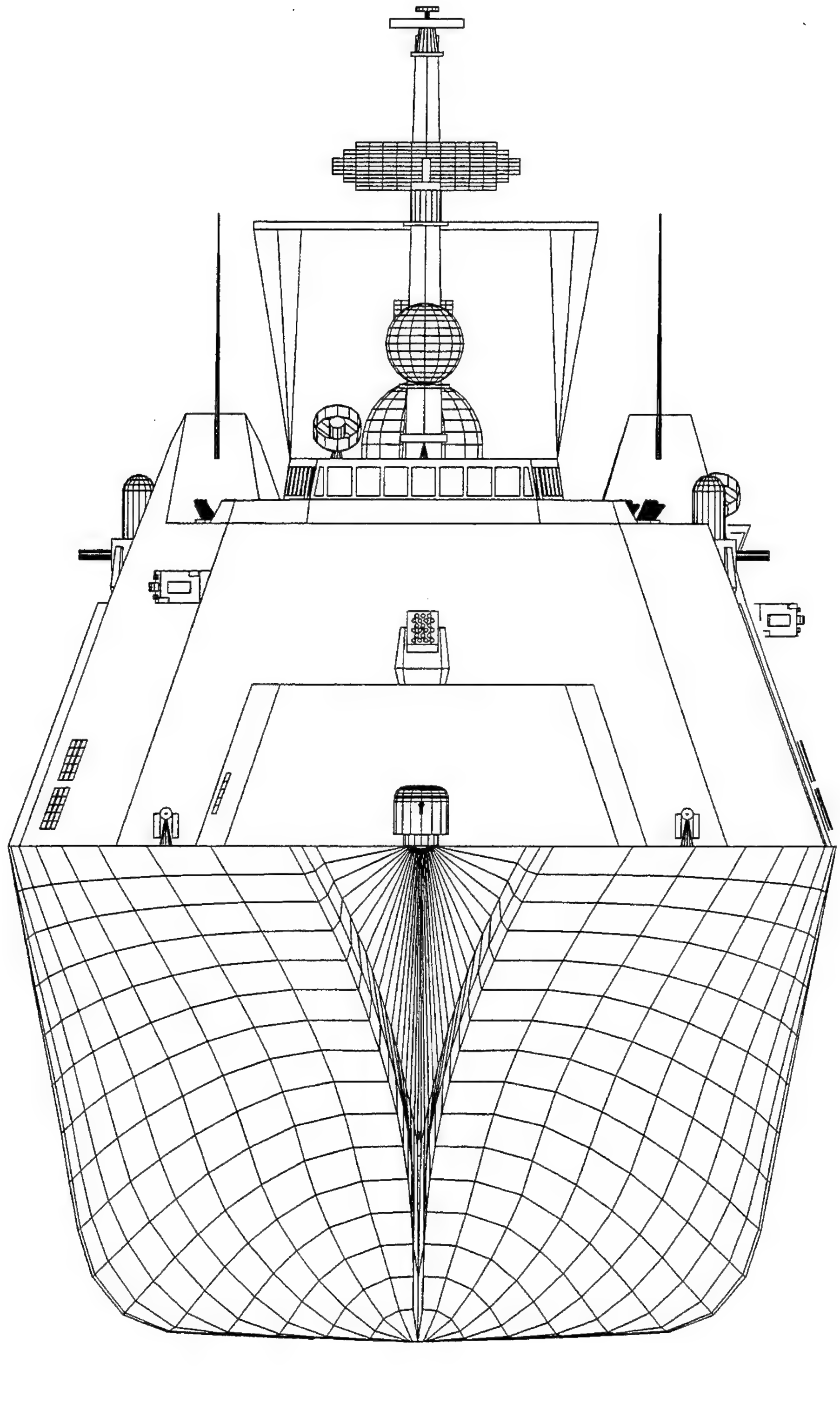
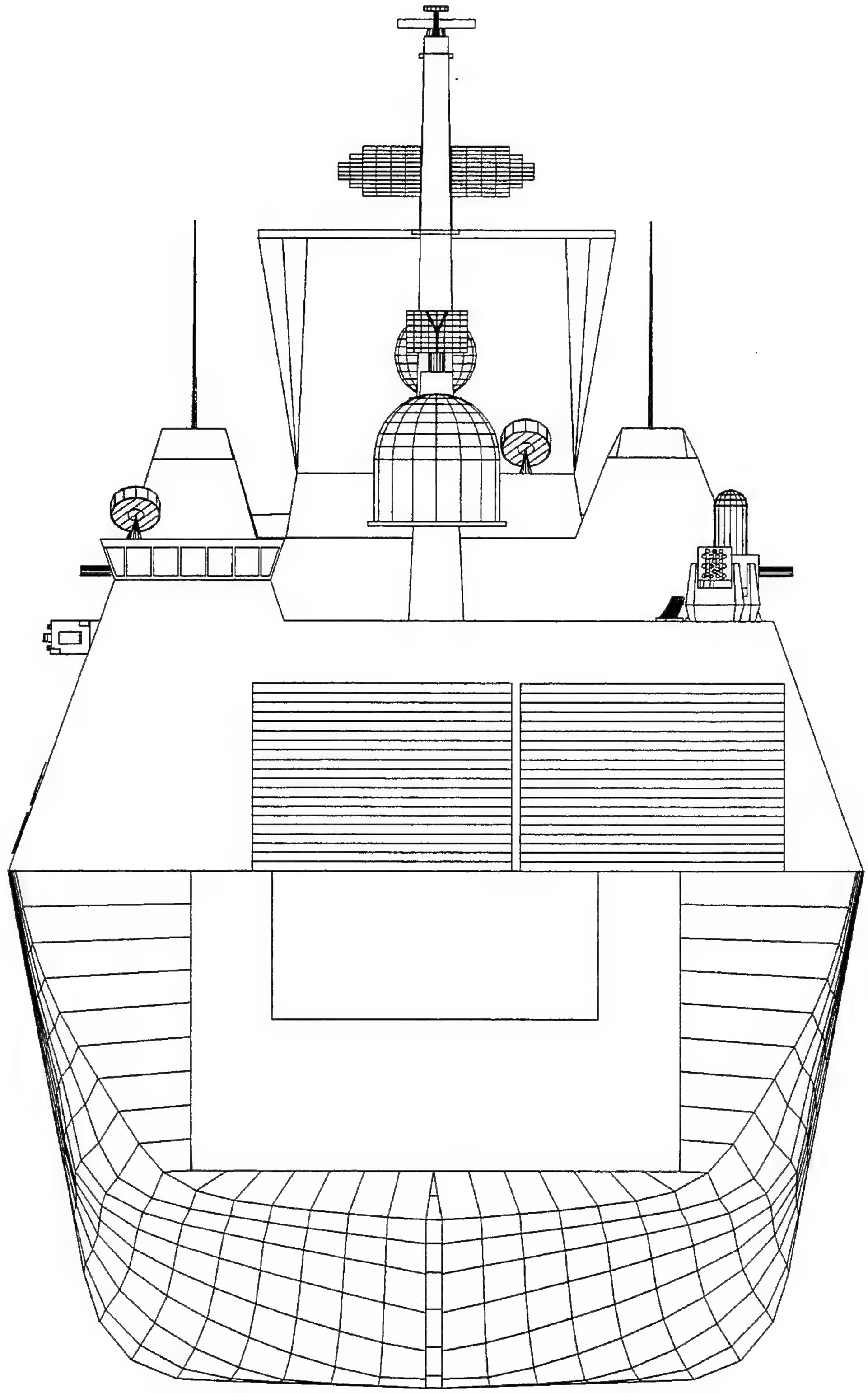


Figure 5-46. Stern View



G. MANNING AND BATTLE ORGANIZATION

1. Manning

Manpower within the SPECTRE concept is based on minimum requirements as delineated in the Design Philosophy. Two key technological elements that support reduced manning are the ship control and information data buses and standardized consoles for all major systems and an automated and simplified power plant.

Manning allowance for the CMD is broken into four groups: ship's crew, Flag, Air Detachment and Boat Detachment. The ship is expected to have the following departments: Operations, Engineering, Deck/Weapons, Air, Supply, Medical and Dental. Division Officers are: CICO, EMO, MPA, A/E, DCA and LAMB plus an additonal 3 junior officers. Estimates for enlisted personnel were based on the Decision Engineering ship design computer program for an initial manning plan. Adjustments were then made for expected technology advances. Similarly, initial estimates for Air Det and Boat Det crews were obtained with the computer program. Due to the offensive capability of many surface PTX platforms, it is anticipated that the Boat Det will have several officers and can be supplemented from ship's force if required. Additionally, manning for the Boat Det accounts for manning to support two 12 hour shifts of all boats. The CMD is designed to support only a small Flag or Group Commander staff. A ship design margin of 5% was incorporated to all categories for growth. The expected manning levels are depicted in table 5-9.

TABLE 5-9

	SHIPS CREW	FLAG	AIR DET	BOAT DET	TOTAL MANNING	TOTAL ACCOMODATIONS
OFFICERS	15	5	18	4	42	43
CPO	12	4	3	8	27	28
OEM	217	3	36	84	340	351
TOTAL	244	12	57	96	409	422

2. Battle Organization

The top level battle organization for condition I is illustrated in figure 5-47. It is anticipated that the critical space manning at condition I will resemble the numbers tabulated in table 5-10.

TABLE 5-10

SPACE	PERSONNEL
Bridge	4 Officer, 8 Enlisted
Combat Information Center	3 Officer, 12 Enlisted
Flag Plot	5 Officer, 6 Enlisted
Central Control Station	2 Officer, 10 Enlisted
Ballast Control Station	1 Officer, 2 Enlisted
Radio Central	1 Officer, 4 Enlisted
Repair Locker 2	1 Officer, 20 Enlisted
Repair Locker 3	1 Officer, 15 Enlisted
Repair Locker 5 - fwd	1 Officer, 25 Enlisted
Repair Locker 5 - aft	1 Officer, 25 Enlisted
Repair Locker 8	1 Officer, 8 Enlisted

The officers designated in table 5-10 may be either commisioned officers or Chief Petty Officers (CPO).

For condition III the top level watch organization will resemble that shown in figure 5-48.

Figure 5-47. Watch Organization (Condition I)

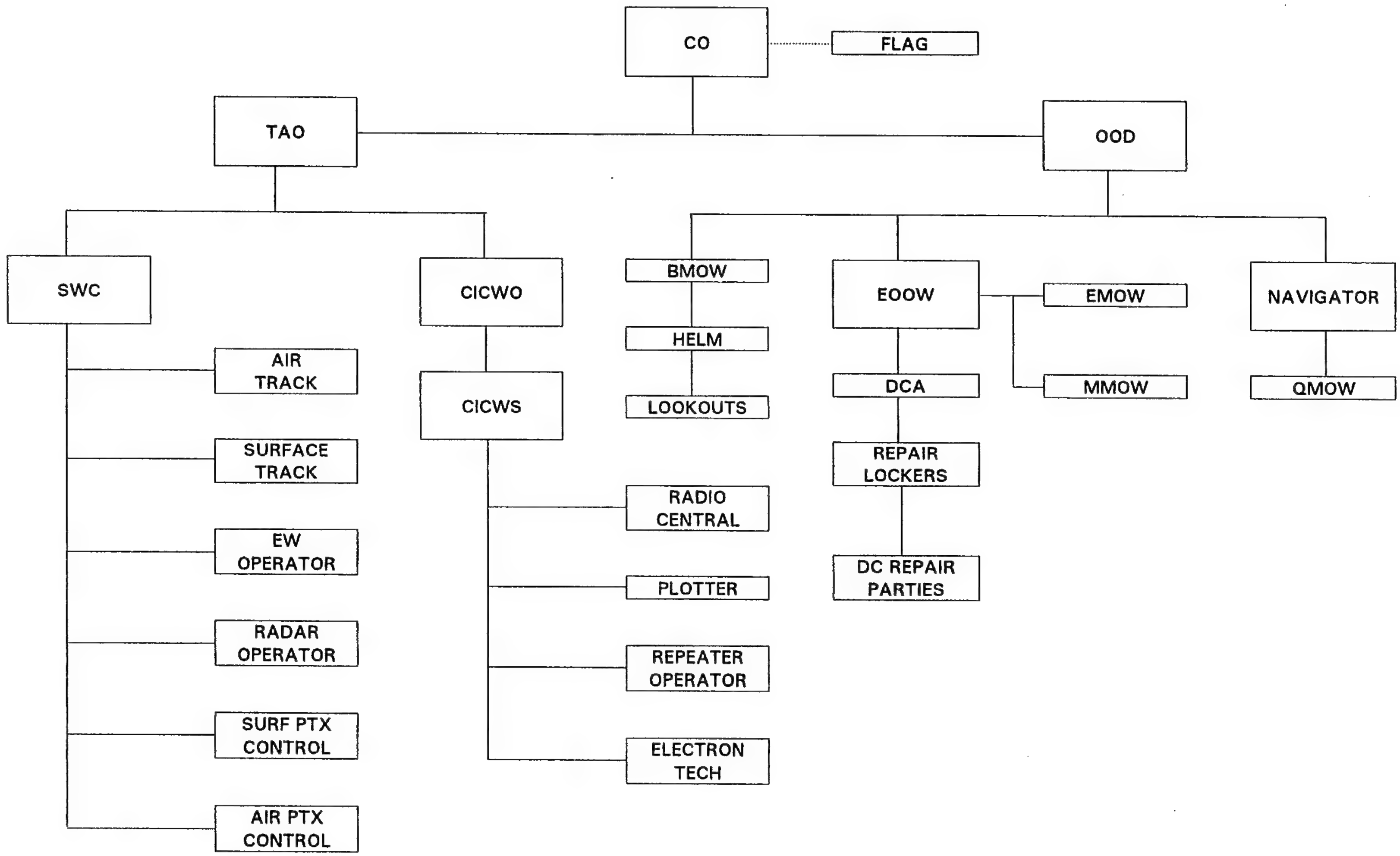
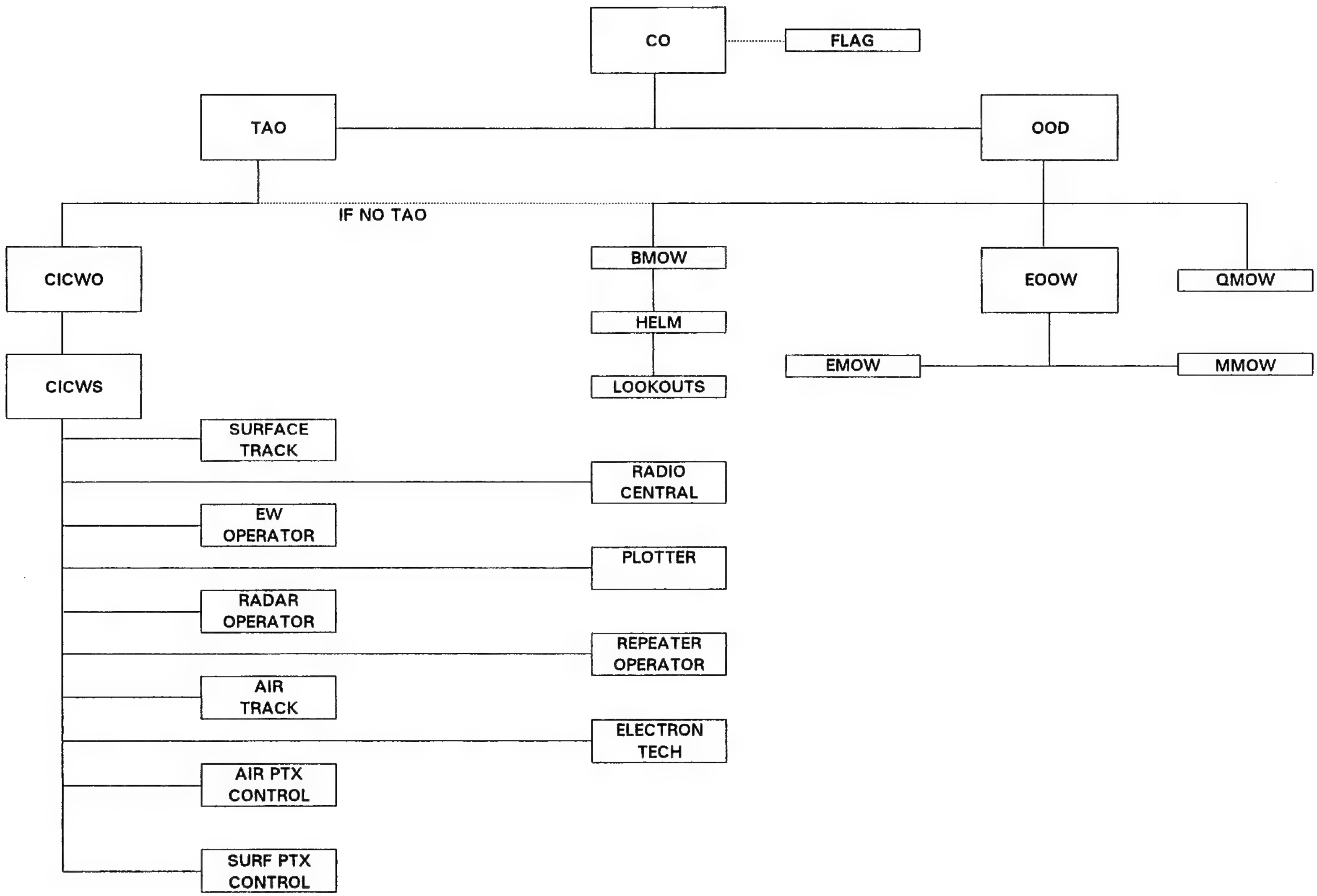


Figure 5-48 Watch Organization (Condition III)



SECTION VI

DESIGN EVALUATION

A. MEASURE OF EFFECTIVENESS STUDIES

Earlier in this report, six scenario based MOE studies were used to select one of three CMD designs. Using the same analysis technique, the SPECTRE task force can be compared to a conventional task force for each scenario.

1. Scenario Based MOE Evaluations

For each scenario, the task force composition, threat levels, defense efficiencies, and loss probabilities are listed in Appendix E. The platform costs and availabilites are as previously listed in section IV-B.

The results of the evaluations are listed in Table 6-1. The measure of effectiveness values are for the combined task forces and the costs are for the task forces in normalized dollars.

Table 6-1. SPECTRE and Conventional Task Force Comparison

	Conventional TF		Large CMD TF		Med CMD TF		Small CMD TF	
Scenario	MOE	Cost	MOE	Cost	MOE	Cost	MOE	Cost
1	0.0556	6.990	0.0907	5.376	0.0885	5.876	0.0869	6.223
2	0.0833	3.340	0.2022	2.646	0.2050	2.583	0.1773	3.493
3	0.0709	3.560	0.3188	1.7560	0.3315	1.6930	0.2530	2.603
4	0.1379	3.320	0.2295	3.072	0.2371	2.946	0.1625	4.766
5	0.1227	2.410	0.2062	2.546	0.2090	2.483	0.1813	3.393
6	0.4941	1.170	0.4061	1.7360	0.3339	2.236	0.2974	2.583

For each scenario, the task force with the highest MOE is highlighted. The SPECTRE task force has a higher MOE and lower cost than the conventional task force in five of the six scenarios. The conventional task force wins in the special operations scenario. Figures 6-1 and 6-2 graphically portray the MOE and cost data.

Figure 6-1. Task Force MOEs

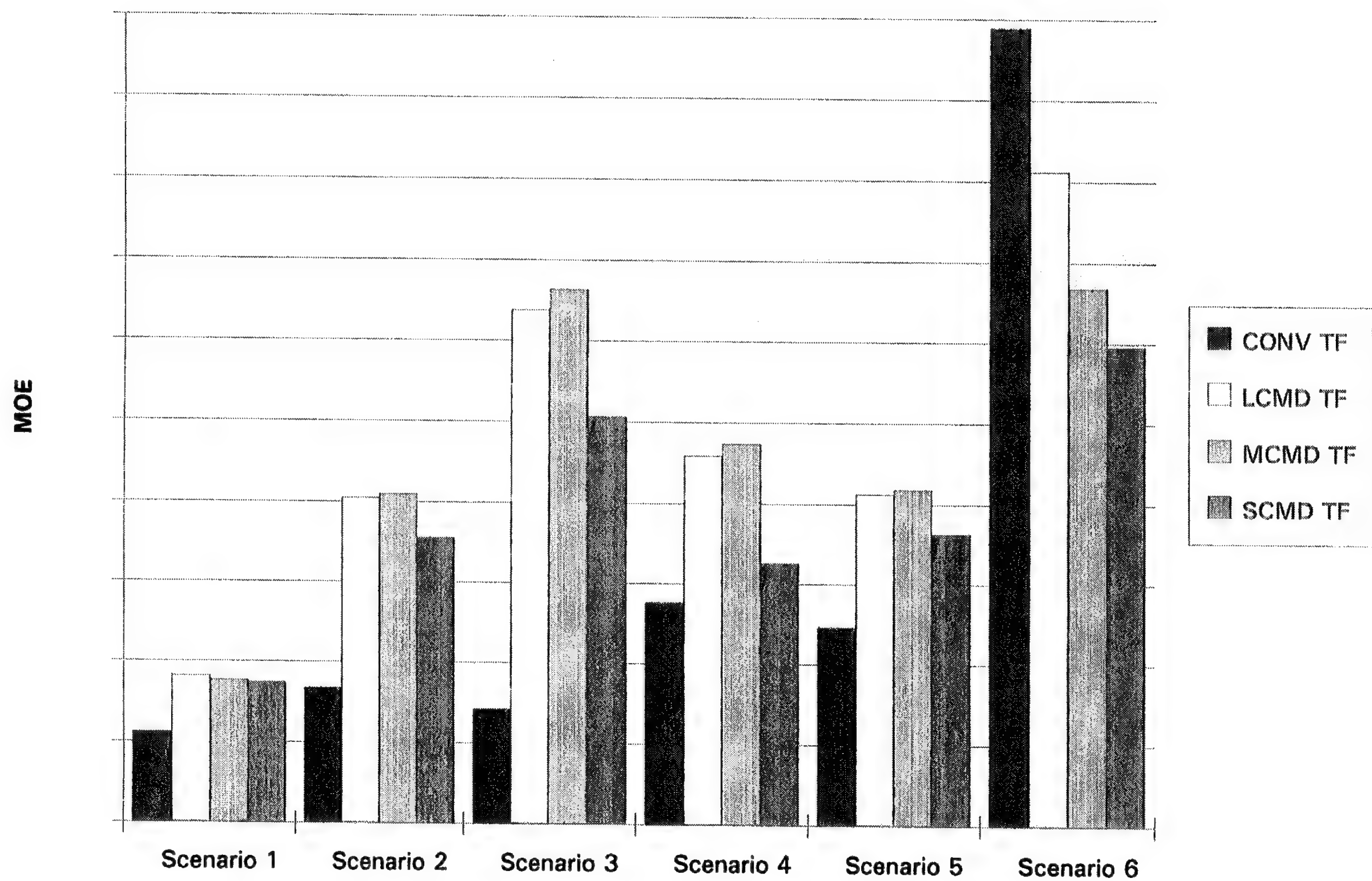
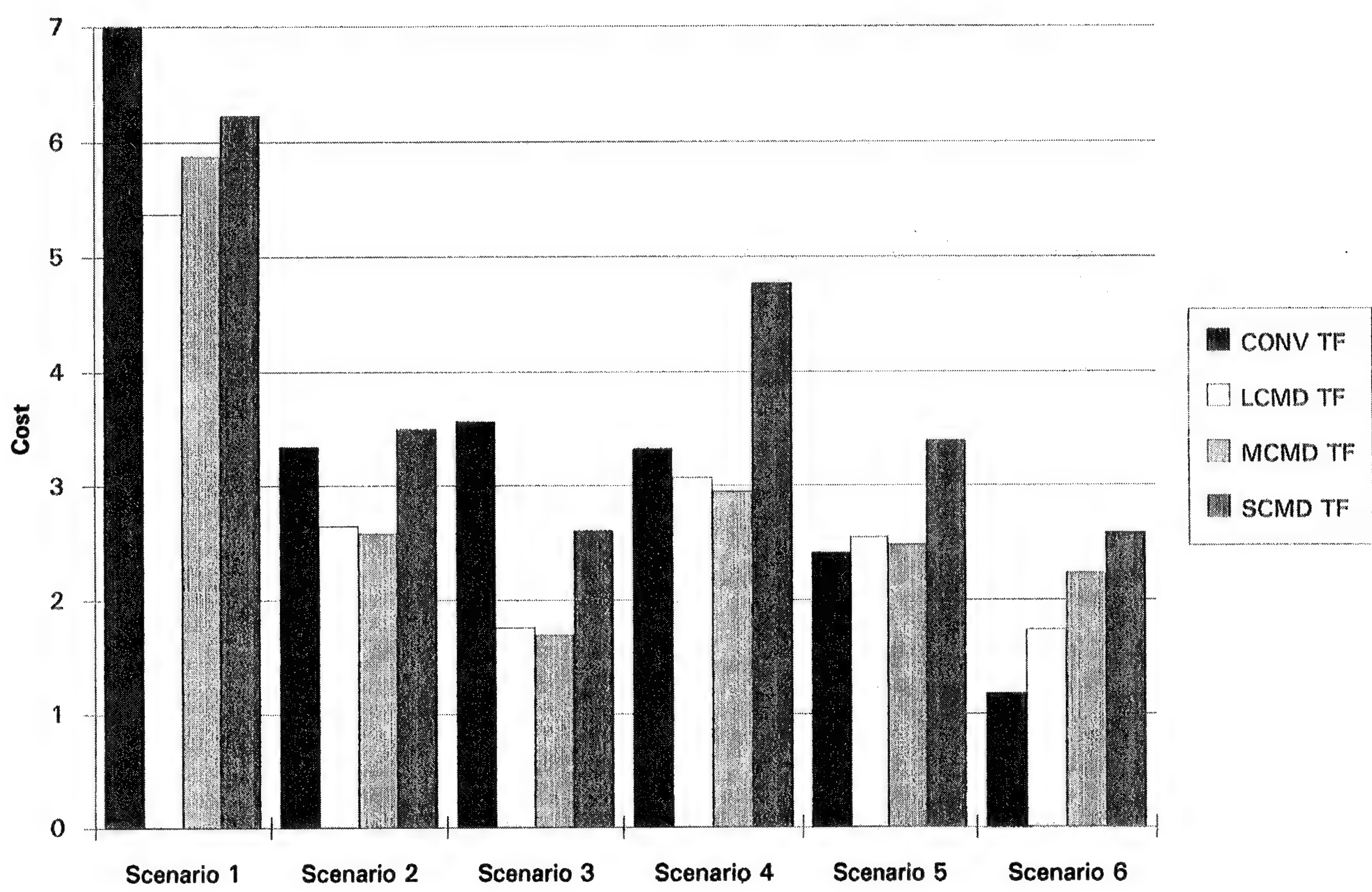


Figure 6-2. Task Force Cost



B. SURVIVABILITY

Survivability was a major design consideration throughout the design process. The use of enclaving including separation and redundancy is evident in all the arrangements chosen. The constraints imposed by the requirements to berth surface PTX craft greatly influence the degree to which survivability can be considered.

1. Radar Cross Section Reduction

The hull is sloped from keel to main deck at 7 degrees and the superstructure also has sloped sides in both the ransverse and longitudinal directions. The two masts are cantered fore and aft at 10 degrees with the total height of the mast reduced from conventional length.

The gas turbine engines are mounted on sound isolation mounts and enclosed in modules to reduce ambient noise. The use of electric drive transmission also provides for decreased ambient noise levels. The uptakes are equipped with an air eductor system to reduce exhaust gas temperatures consequently reducing the ships infrared signature.

2. Single-Point Failure Reduction

The use of enclaving and the inherent separation of systems within the SPECTRE concept greatly eliminates the single-point failure spaces on the CMD platform. Equipment has been effectively separated on the CMD itself to the maximum extent possible given the general design constraint in the ORD. For example: the two RAM launchers are located in separate zones, MMR1 is vertically separated from MMR2 and AMR2, SRBOC launchers are interspersed throughout the topside arrangements, CIC is separated from the bridge by a complete deck and flag plot, which will act as secondary CIC, is located in a separate zone from CIC. The use of electric drive allows for increased survivability from underwater detonation as fewer vital spaces are located below the water line.

A few single-point failure nodes do exist. The CIWS are located in the same zone. The SPN-35 and SPN-43 are both located on the after mast. The Mk-92 CAS is separated from the 76mm gun which is not in compliance with the enclaving concept. CIC, the bridge and CCS are all located in zone II.

C. RECOMMENDATIONS AND CONCLUSIONS

1. Recommendations

There are a number of items remaining to be investigated prior to and in the detailed design phase. Some of the more important items are as follows.

Use ASSET to determine the final stability characteristics based on the new AUTOCAD design. The stability information provided by the TSSE students is based on the original medium sized CMD without the weapons and detection systems installed.

Design of the individual surface PTX craft remains and the CMD imposes constraints on their size and operational requirements. The surface PTX craft are envisioned to have weapons modules carried aboard the CMD to provide for a flexible response if mission areas change.

The detailed arrangements of the Main Machinery Rooms and Auxiliary Machinery Rooms remains along with the intake and uptake design. A high degree of machinery instrumentation is required to keep the size of the crew at an acceptable level.

Conduct a complete survivability analysis of the CMD with PTX craft operational. This will undoubtably be a very complex task and will necessitate a computer model based on the operational scenarios previously developed.

Explore alternative scenarios using the CMD and PTX platforms and determine the SPECTRE effectiveness compared to current operational doctrine.

2. Conclusions

The CMD design developed by the TSSE students is a viable alternative to current Navy tactics and doctrine. The SPECTRE concept meets the requirements of ever changing missions of the U.S. Navy. The concept of SPECTRE is well suited to littoral warfare and the use of interchangeable modules for the PTX craft allows for rapid response to changing threat environments.

The low cost, ease of maintainability and low probability of loss of life due to a small crew will provide a good political argument for the acceptance of the SPECTRE system. The system was designed to operate as a complete and separate entity in naval warfare situations.

The requirements specified in the ORD have been met and the proposed system, as designed, should provide policy makers with an added option in ship acquisition.

3. Value of Design as a Learning Tool

The design undertaken by the TSSE students was a valuable learning tool in understanding the ship design process. The importance of well defined requirements was made evident as the ship design progressed through the preliminary design phase.

The team work used in this design allowed all members of the team to contribute their own background knowledge throughout the design process.

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APPENDIX A

COMBAT SYSTEM DECISION MATRICES

Radar Design Priority Selection Matrix

Design Priority	Weight Factor		LN-66		SPS-55		SPS-63		SPS-64		SPS-67	
Cost	10		2	20	2	20	2	20	3	30	1	10
Mission Effectiveness	9		2	18	2	18	2	18	2	18	3	27
Mission Flexibility	8		3	24	2	16	1	8	3	24	3	24
Survivability	6		2	12	2	12	2	12	2	12	3	18
Enclaving	6		2	12	1	6	2	12	3	18	1	6
R M & A	6		2	12	2	12	2	12	3	18	2	12
ATC	4		1	4	2	8	1	4	3	12	2	8
COTS	4		1	4	1	4	1	4	3	12	1	4
Producibility	2		2	4	2	4	2	4	3	6	1	2
Habitability	2		n/a		n/a		n/a		n/a		n/a	
Reduced Manning	2		n/a		n/a		n/a		n/a		n/a	
Environmental	2		n/a		n/a		n/a		n/a		n/a	
Future Growth	1		1	1	2	2	1	1	2	2	2	2
Fuel Economy	1		n/a		n/a		n/a		n/a		n/a	
Size	1		3	3	2	2	2	2	3	3	1	1
Totals				114		104		97		155		114

Radar Physical Properties

Property	LN-66	SPS-55	SPS-63	SPS64	SPS-67
Purpose	SS/N	SS/N	SS/N	SS/N	SS/N
Frequency	9375	9.05-10	9375	9375	
(Hz)		(GHz)		3030	
Peak Pwr	6,90	130	7,20	10,25,50	
(kw)	12			60	
Rotation	24	16	25		
(rpm)	22				
PW	0.1,1.0	1.0,0.12	0.05,0.15	0.06,0.5,1.0	0.1,0.25,1.0
(micro sec)	0.5,0.9		0.5,1.5		
PRF	500,2000	750,2250	6000,3000	3600,1800,900	
(Hz)	800,1250,2500		1500,750		
Weight	9.7,34,22	90		59,61,64,145	
(kg)	9.7,13.4,23				
Range			40 NM	18.3m-118.5km	
				27.4m-118.5km	
Optional	GFC/ASW	AAW/ASW	AAW	FC/ESM	GFC/CC
Roles				CA/TT/TD	
Other		Does not include display.		Comercial high reliability & performance, fully modular	5 cabinets below deck, SEM & BIT technology, Survivable antenna

AIR SEARCH RADAR SELECTION MATRIX

Design Priority	Weight Factor		SPS-40E (2-D)		SPS-49 (2-D)		SPS-65 (2-D)		SPS-48E (3-D)		SPS-52C (3-D)		SPY-1B (3-D)	
Cost	10		3	30	1	10	2	20	2	20	3	30	1	10
Mission Effectiveness	9		1	9	3	27	2	18	2	18	1	9	3	27
Mission Flexibility	8		1	8	3	24	2	16	2	16	1	8	3	24
Survivability	6		2	12	2	12	2	12	2	12	2	12	2	12
Enclaving	6		2	12	1	6	3	18	2	12	3	18	1	6
R M & A	6		1	6	3	18	2	12	3	18	2	12	1	6
ATC	4		1	4	3	12	2	8	3	12	3	12	1	4
COTS	4		1	4	1	4	1	4	1	4	1	4	1	4
Producibility	2		2	4	2	4	2	4	2	4	3	6	1	2
Habitability	2		n/a		n/a		n/a		n/a		n/a		n/a	
Reduced Manning	2		n/a		n/a		n/a		3	6	3	6	1	2
Environmental	2		n/a		n/a		n/a		n/a		n/a		n/a	
Future Growth	1		1	1	2	2	3	3	1	1	2	2	3	3
Fuel Economy	1		n/a		n/a		n/a		n/a		n/a		n/a	
Size	1		1	1	2	2	3	3	2	2	3	3	1	1
Totals	64	192	15	91	20	121	22	118	20	119	23	116	15	99
	(minimum)	(maximum)												

	RADAR PROPERTIES					
	SPS-40	**SPS-48**	**SPS49**	**SPS-52**	**SPS-65**	**SPY-1**
PEAK Kw	130	2200	360	1000	12	6000
MAX RANGE (nm)	200	220	~250	280	100	175
ANT WT (lbs)	1728	5684	3040	3200	439	7900 (per face)
BELOW WT (lbs)	3474	24018	14010	14040	1594	131584
MTBF (hrs)	252	268-586	>600	216	350	???
BAND	UHF	S	L	S	L	S

Design Philosophy	Weight Factor	SLQ-54 AIEWS/MATES	SLQ-32 V2	SLQ-32 V3	SHIELDS V2	ALR-66A V6	Locator 2000	APR-39A V2/ SIEWS subsystems
Element Cost	10	1	2	2	3	3	3	2
Mission Effectivenes	9	3	1	2	2	1	1	3
Mission Flexibility	8	3	1	2	2	1	1	3
Survivability	6	3	1	2	1	1	1	2
Enclaving	6	1	1	1	1	1	1	1
R,M&A	6	3	3	3	1	1	1	2
ATC	4	3	2	2	1	1	1	2
COTS	4	1	1	1	1	2	2	2
Producibility	2	1	1	1	1	2	2	2
Habitability	2	3	2	2	1	1	1	2
Reduced Manning	2	1	2	2	2	3	3	2
Environmental	2	2	2	2	2	2	2	2
Future Growth	1	3	1	1	1	1	1	1
Fuel Economy	1	1	2	1	2	3	3	2
Size	1	1	2	1	2	3	3	2
TOTAL		138	98	119	107	100	100	138

Characteristics	SLQ-54 AIEWS/MATES	SLQ-32 V2	SLQ-32 V3	SHIELDS V2	ALR-66A V6	Locator 2000	APR-39A V2/ SIEWS subsystems
Frequency Range	H	H	H	H	M	M	H
Jamming Capability RF	H	N/A	H	H	N/A	N/A	H
Jamming Capability IR	H	N/A	N/A	N/A	N/A	N/A	H
IR Detection	H	N/A	N/A	N/A	N/A	N/A	H
Laser Detection	H	N/A	N/A	N/A	N/A	N/A	H
Integrates w/ Self Defense Syste	H	H	H	N/A	H	H	H
Automation Features	H	M	M	L	L	H	H
Wieght/Volume	H	M	H	L	L	L	L
Fiber Optics Data Bus	H	N/A	N/A	N/A	N/A	N/A	N/A
Upgradeable	H	M	M	L	L	L	H
Ergonomcally Designed	H	M	M	M	M	L	M

SCSE.XLS

Design Philosophy	Weight Factor	SRBOC DLS	ALEX DLS	SSTDS	SLQ-25/36 Nixie	AN/SSQ-25
Element Cost	10	1	2	1	2	3
Mission Effectivenes	9	1	3	3	1	2
Mission Flexibility	8	1	3	3	1	3
Survivability	6	1	3	3	1	3
Enclaving	6	3	3	1	1	3
R,M&A	6	3	2	3	2	3
ATC	4	2	2	2	2	2
COTS	4	2	2	1	1	3
Producibility	2	3	3	1	2	3
Habitability	2	1	3	2	1	2
Reduced Manning	2	2	3	1	1	2
Environmental	2	1	1	2	2	1
Future Growth	1	1	1	3	1	1
Fuel Economy	1	2	2	2	2	1
Size	1	2	2	2	2	3
TOTAL		104	160	134	90	167

Characteristics	SRBOC DLS	ALEX DLS	SSTDS	SLQ-25/36 Nixie	AN/SSQ-25
Integration w/ EW Systems	L	H	unk	N/A	N/A
Automation Features	M	H	unk	L	N/A
Weight/Volume	L	L	unk	L	L
Fiber Optics Data Bus	N/A	N/A	unk	N/A	N/A
Upgradeable/Modular Design	L	H	unk	L	N/A
Ergonomcally Designed	L	H	unk	L	N/A
Support Requirements	L	L	unk	M	H

Note: SRBOC and ALEX use any of the following pods:

- FLYRT
- CHAFFSTAR
- HIRAM III/IV
- TORCH
- GEMINI

APPENDIX B

SMALL CMD ASSET DATA

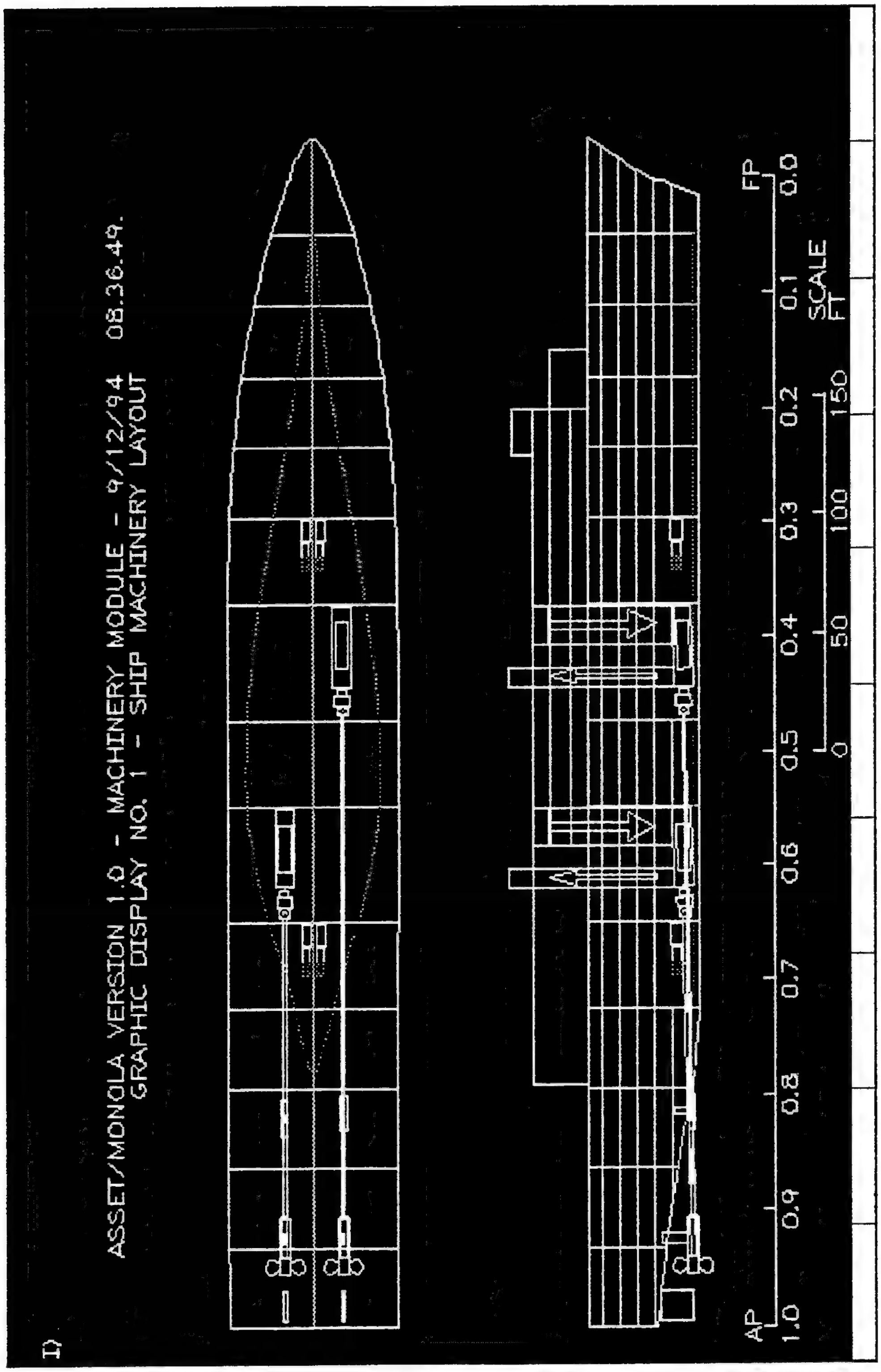
```
ALL OF SHIP 'CMD03' HAS BEEN USED.

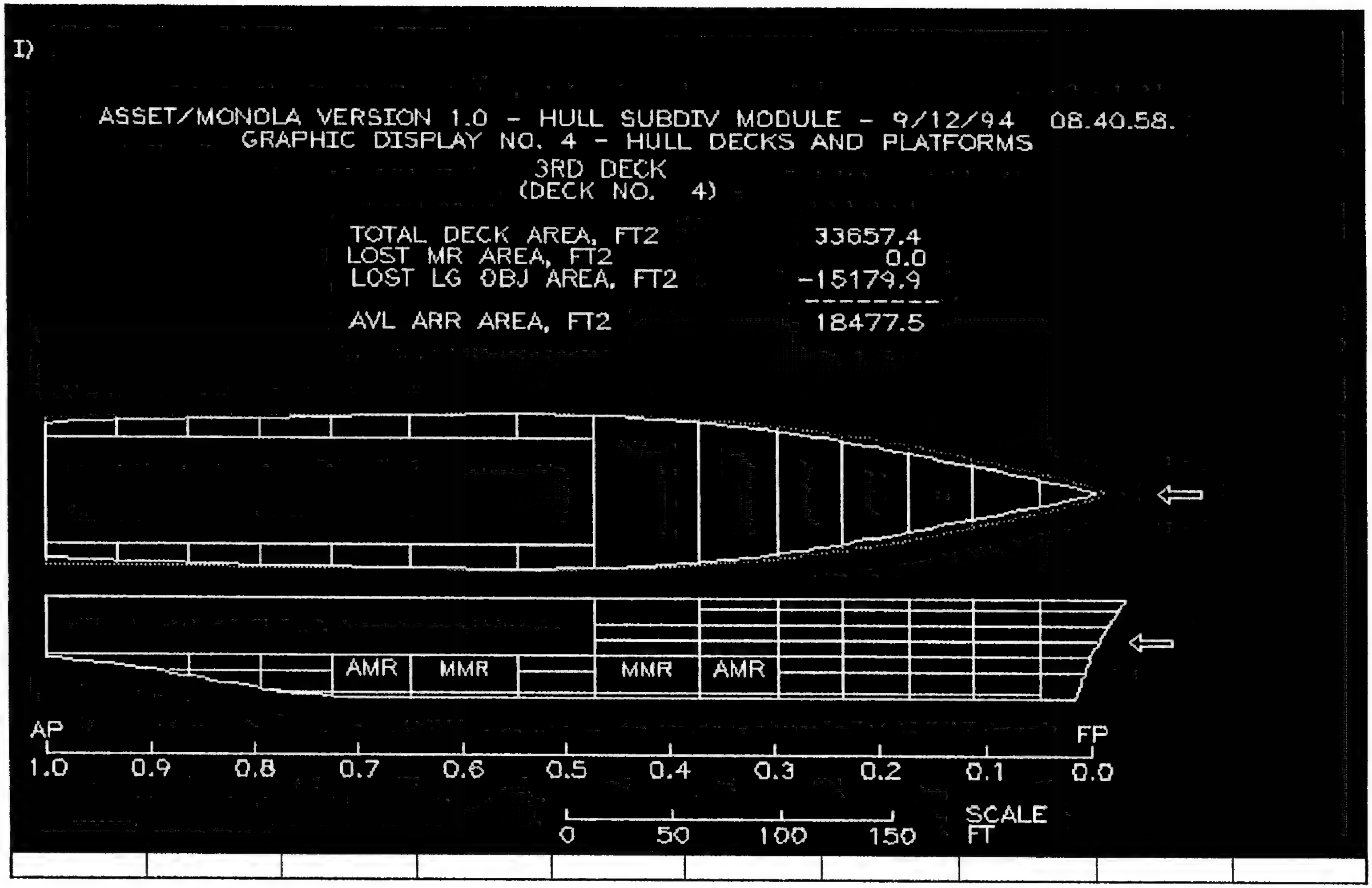
   ASSET/MONOLA VERSION 1.0 - DESIGN SUMMARY - 9/16/94  12.33.58.

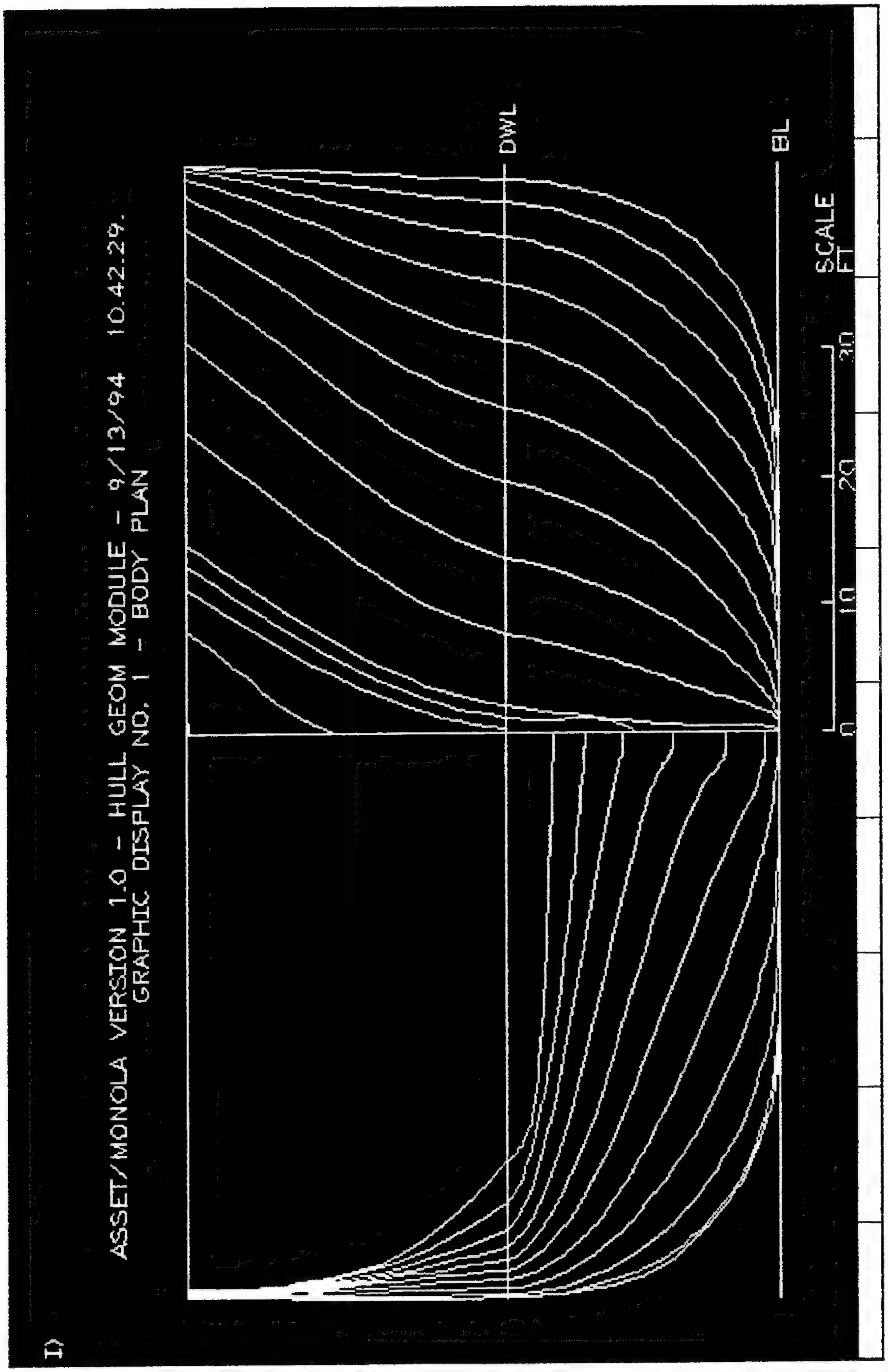
PRINTED REPORT NO. 1 - SUMMARY

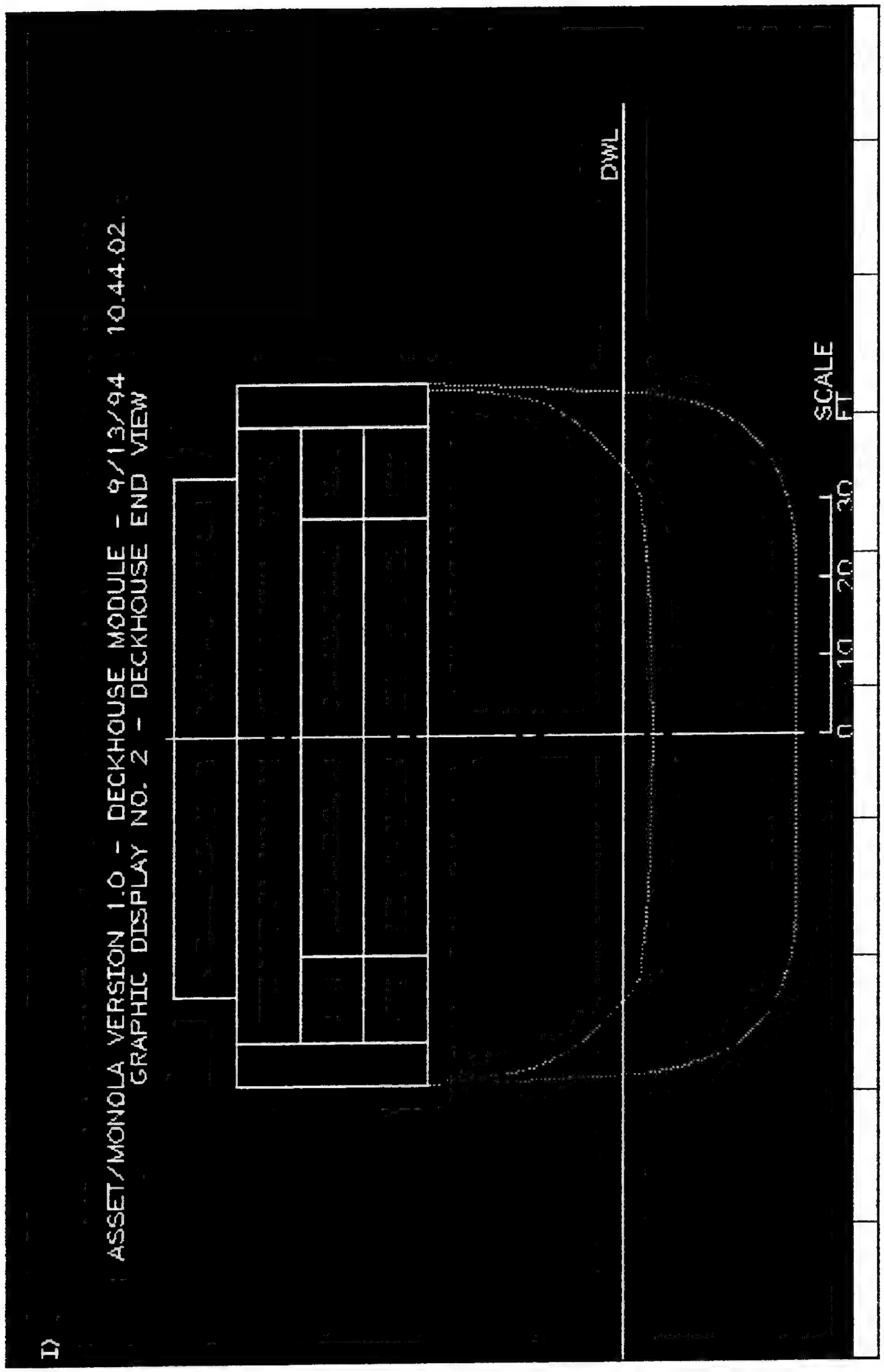
SHIP COMMENT TABLE

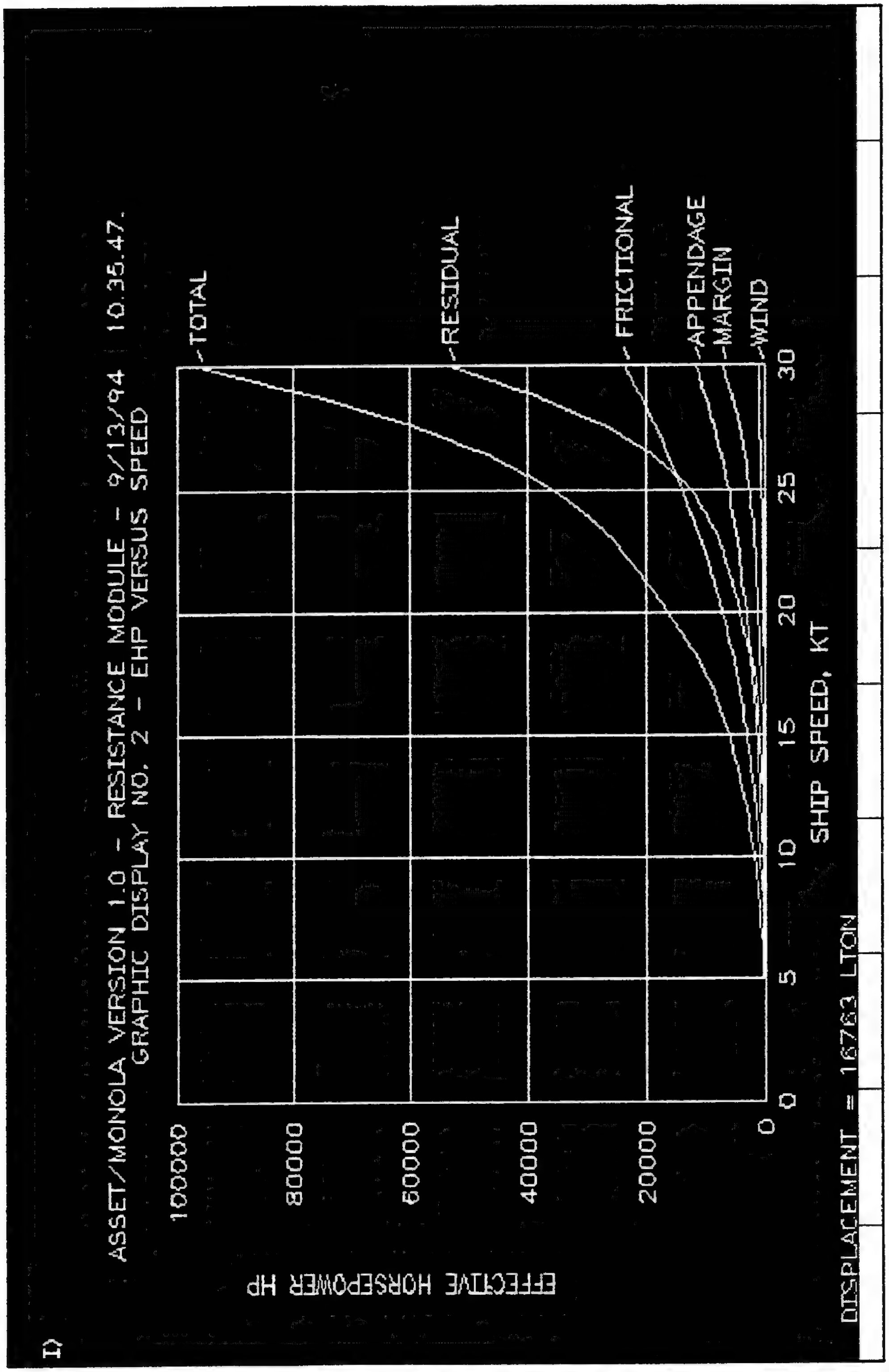
 PRINCIPAL CHARACTERISTICS - FT        WEIGHT SUMMARY - LTON
LBP                    479.9  GROUP 1 - HULL STRUCTURE  6118.4
LOA                    495.7  GROUP 2 - PROP PLANT      2001.0
BEAM, DWL               88.0  GROUP 3 - ELECT PLANT      431.4
BEAM, WEATHER DECK      88.0  GROUP 4 - COMM + SURVEIL   133.5
DEPTH @ STA 10          57.0  GROUP 5 - AUX SYSTEMS     1315.1
DRAFT TO KEEL DWL       26.3  GROUP 6 - OUTFIT + FURN    840.8
DRAFT TO KEEL LWL       26.3  GROUP 7 - ARMAMENT          50.9
FREEBOARD @ STA 3       34.7  --------------------------------
GMT                      9.3  SUM GROUPS 1-7         10891.2
CP                     0.570  DESIGN MARGIN           1362.7
CX                     0.920  --------------------------------
                              LIGHTSHIP WEIGHT       12253.9
SPEED(KT):  MAX= 27.2  SUST= 26.0   LOADS            4528.5
ENDURANCE:  6000.0 NM AT 16.0 KTS  --------------------------------
                              FULL LOAD DISPLACEMENT  16782.4
TRANSMISSION TYPE:       MECH   FULL LOAD KG:  FT      34.5
MAIN ENG: 2 GT      @ 42907.2 HP
                              MILITARY PAYLOAD WT - LTON   0.0
SHAFT POWER/SHAFT:    41927.2 HP   USABLE FUEL WT - LTON   2051.6
PROPELLERS: 2 - CP  - 20.0 FT DIA
                              AREA SUMMARY - FT2
SEP GEN:  4 F DIESEL @  1500.0 KW   HULL AREA        - 104765.7
                              SUPERSTRUCTURE AREA  -  76036.3
                              --------------------------------
24 HR LOAD           3204.4   TOTAL AREA           180801.9
MAX MARG ELECT LOAD      9386.6
                              VOLUME SUMMARY  - FT3
      OFF  CPO  ENL   TOTAL   HULL VOLUME          - 1671170.5
MANNING  28  25  312    365   SUPERSTRUCTURE VOLUME -  760362.6
ACCOM    30  27  340    397   --------------------------------
                              TOTAL VOLUME          2431533.0
```


ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 9/12/94 08.36.49.
GRAPHIC DISPLAY NO. 1 - SHIP MACHINERY LAYOUT
AP
FP
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
SCALE
FT
0
50
100
150


I)
ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 9/12/94 08.40.58.
GRAPHIC DISPLAY NO. 4 - HULL DECKS AND PLATFORMS
3RD DECK
(DECK NO. 4)
TOTAL DECK AREA, FT2 33657.4
LOST MR AREA, FT2 0.0
LOST LG OBJ AREA, FT2 -15179.9
AVL ARR AREA, FT2 18477.5
AMR
MMR
MMR
AMR
AP
FP
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
SCALE
FT
0
50
100
150


ASSET/MONOLA VERSION 1.0 - HULL GEOM MODULE - 9/13/94 10.42.29.
GRAPHIC DISPLAY NO. 1 - BODY PLAN
DWL
BL
SCALE
FT
0
10
20
30


ASSET/MONOLA VERSION 1.0 - DECKHOUSE MODULE - 9/13/94 10.44.02
GRAPHIC DISPLAY NO. 2 - DECKHOUSE END VIEW
DWL
SCALE
FT
0 10 20 30


ASSET/MONOLA VERSION 1.0 - RESISTANCE MODULE - 9/13/94 10.35.47.
GRAPHIC DISPLAY NO. 2 - EHP VERSUS SPEED
EFFECTIVE HORSEPOWER HP
100000
80000
60000
40000
20000
0
0
5
10
15
20
25
30
SHIP SPEED, KT
TOTAL
RESIDUAL
FRICTIONAL
APPENDAGE
MARGIN
WIND
DISPLACEMENT = 16763 LTON

AIRCRAFT PAYLOAD MODEL 08-24-1994

TYPE AND NUMBER OF AIRCRAFT

. CH-53D PROVISIONS FOR 2 SORTIES/DAY, 7 DAYS OF OPERATION

PROVISIONS EXPENDITURE FACTOR = .2
NUMBER OF CRANES = 1
NUMBER OF ELEVATORS = 0
NUMBER OF WIRES FOR ARRESTING GEAR = 0
NUMBER OF STEAM CATAPULTS = 0
FIN STABILIZERS = NO
HAUL DOWN SYSTEM = NO
SKI JUMP = NO
NUMBER OF SORTIES FOR EACH DAY = 0
NUMBER OF DAYS FOR DEPLOYMENT = 0
LENGTH OF LANDING DECK IN FEET = 100
WIDTH OF LANDING DECK IN FEET = 80
LENGTH OF TAKEOFF DECK IN FEET = 100
WIDTH OF TAKEOFF DECK IN FEET = 80
SAME DECK FOR TAKEOFFS AND LANDINGS
LANDING DECK/TAKEOFF DECK CONSTRUCTION AND MATERIALS = MILD STEEL
LEVEL OF MAINTENANCE FOR HANGER AREA IS LEVEL II
HANGER LOCATION IS ON DECK
HANGER CONSTRUCTION MATERIAL IS MILD STEEL

PROVISIONS MADE FOR THE FOLLOWING AIRCRAFT LOADS:

MAINTENANCE LEVEL O FOR HANGAR AREA
HANGAR LOCATION IS ON DECK
HANGAR CONSTRUCTION MATERIAL IS MILD STEEL
PERCENTAGE OF AIRCRAFT IN HANGAR = 50 % ,
LEADING TO 2677.143 SQFT HANGAR AREA
NUMBER OF CRANES = 1

WEIGHT SWBS	DESCRIPTION		WEIGHT, LT
42313	TACAN	=	0.55
4272	NAVIGATION ALIGNMENT SYSTEM	=	1.00
454	AIRCRAFT CONTROL APPROACH RADAR	=	10.37
492	FLIGHT CONTROL & INST. LANDING	=	6.00
533	GAS SYSTEM	=	0.00
542	JP-5 SYSTEMS	=	6.00
586	CRANE (AC & BOAT)	=	67.00
588	AIRCRAFT HANDLING SERVICE, STOWG	=	168.55
661	OFFICES	=	7.00
665	WORKSHOPS	=	8.50
672	STOREROOMS	=	12.00
782	WEAPONS HANDLING	=	0.29
783	WEAPONS STOWAGE	=	6.92
792	SPECIAL WEAPONS HANDLING/STOWAGE	=	0.00

****** AIRCRAFT SYSTEM (NO LOADS) ******

TOTAL WEIGHT OF AIRCRAFT SYSTEM IN TONS = 2237.08

```
      ****** MANNING ******
F16   NUMBER OF OFFICERS     =  3
F16   NUMBER OF CPO'S        =  2
F16   NUMBER OF ENLISTED MEN =  6


AREA SWBS          DESCRIPTION                       AREA, SQFT
     1.32    AVIATION CONTROL AREA                    =  240.00
        1.3233  AVIATION PLAN & READY ROOM               =   240.00

     1.35    AVIATION ADMINISTRATION AREA             =  230.00
        1.351   AIR INTERMEDIATE MAINTENANCE DEPT =   143.52
        1.352   AIR DEPARTMENT                           =     6.90
        1.353   AIR WING (SQUADRON OFFICES)              =    79.58

     1.36    AVIATION MAINTENANCE AREA                =  444.00
        1.361   AIRFRAME                                 =    36.41
        1.362   AVIONICS MAINTENANCE AREA                =   195.36
        1.3642  AVIATION JET MAINTENANCE SHOP            =    45.73
        1.3649  AVIATION FUEL MAINTENANCE AREA           =     3.11
        1.365   SURVIVAL EQUIPMENT                       =    17.32
        1.367   GROUND SUPPORT EQUIPMENT                 =    26.20
        1.369   ORGANIZATIONAL LEVEL FACILITIES          =   119.44

     1.38    AVIATION FUEL SYSTEM AREA                =  370.00

     1.39    AVIATION STORES AREA                     = -123.00
        1.3912  SD SR (AVIATION)                         =    -3.57
        1.3921  AIRFRAME                                 =   -45.76
        1.3922  AVIONICS                                 =   -20.30
        1.3923  ORDNANCE                                 =    -2.83
        1.3924  POWERPLANT                               =   -13.28
        1.394   FLIGHT CLOTHING                          =   -33.21
        1.397   SQUADRON                                 =    -4.06

  TAL AREA OF AIRCRAFT SYSTEM IN SQUARE FEET  =  1213


                  ****** LOADS ******
F22     WEIGHT ORDNANCE LOAD IN TONS                  = 0
F22     VOLUME ORDNANCE LOAD IN CUBIC FEET            = 0
F22     MAGAZINE ORDNANCE AREA IN SQUARE FEET         = 0
F23     AIRCRAFT WEIGHT, TONS                         = 21.05357
F26     AIRCRAFT SPARES WEIGHT, TONS                  = 8.421429
F29     SPECIAL LOADS WGT (SONOBOUYS,PODS), TONS      = 0
F29     SPECIAL LOADS VOL, CUBIC FEET                 = 0
F42     JP-5 LOAD WEIGHT, TONS                        = 74.75
F42     JP-5 VOLUME, CUBIC FEET                       = 3354.167
TOTAL AIRCRAFT LOADS WEIGHT IN TONS         =  95.80358
TOTAL AIRCRAFT LOADS VOLUME IN CUBIC FEET =  3354.167
```

PAYLOAD-LIMITED TECHNOLOGY ASSESSMENT 08-24-1994

SHIP TYPE - CMD SMALL VARIANT - CRP, MECHANICAL

SEE PAGE 2 FOR LIST OF TECHNOLOGIES INCORPORATED

MAIN ENGINES - 3 LM2500-30 GAS TURBINES
VERTICALLY MOUNTED EXHAUST WITH STACK
MECHANICAL TRANSMISSION
GENERATOR TYPE - LM500
STEEL SUPERSTRUCTURE
COMPENSATED FUEL SYSTEM

WEIGHT IN LONG TONS	
SHIP DISPLACEMENT	18481.20
HULL WEIGHT	8550.14
SURVIVABILITY WEIGHT	25.50
PROPULSION WEIGHT	464.50
ELECTRICAL WEIGHT	496.16
PAYLOAD WEIGHT	3814.08
AUXILIARY WEIGHT	1494.51
OUTFITTNG WEIGHT	1013.40
REDUNDANCY WEIGHT	0.00
FUEL WEIGHT	1639.09
LOADS WEIGHT	458.29
MARGINS WEIGHT	525.54

VOLUME IN CUBIC FEET	
SHIP VOLUME	2530436.00
PROPULSION VOLUME	129843.40
ELECTRICAL VOLUME	71100.00
PAYLOAD VOLUME	1151558.00
AUXILIARY VOLUME	379358.60
PERSONNEL VOLUME	238356.30
REDUNDANCY VOLUME	0.00
OFFICES/SHOPS VOLUME	455230.30
LOADS VOLUME	7943.94
FUEL VOLUME	71755.04
MARGINS VOLUME	0.00

POWER PLANT PARAMETERS	
CRUISE BHP	10470.39
SUSTAINED BHP	60018.51
MAXIMUM BHP	74915.56
INSTALLED BHP	75000.00
NO OF ENGINES	3
PROPULSION SFC	0.66
SUSTAINED SPEED KTS	25.97
MAXIMUM SPEED KTS	27.50
CRUISE SPEED KNOTS	16.00
MIN SUSTAINED SPEED KNO	24.00
INSTALLED ELECTRIC KW	9000.00
CRUISE ELECTRIC LOAD	2965.09
NO OF GENERATORS	3
GENERATOR SFC	0.87

SHIP CHARACTERISTICS	
CREW SIZE	346.70
ACCOMMODATIONS	381.37
SHIP LENGTH FEET	603.88
SHIP BEAM FEET	82.27
SHIP DRAFT FT	20.57
METACENTRIC HEIGHT FT	36.60
CENTER OF GRAVITY FT	29.99
GM INTACT STABILITY FT	6.61
RANGE N.MI.	6000.00

RANGE IN MILES	
UNDERWATER NOISE RANGE	66.00
IR DETECTION RANGE	4.59
RADAR DETECTION RANGE	250.00

COST IN MILLIONS OF DOLLARS	
AVERAGE FIRST COST	490.97
O&S COST PER YEAR	25.06

(SEE PAGE 2 FOR LIST OF TECHNOLOGIES INCORPORATED)

PAGE 2

COMBAT PAYLOAD	
CU FT OF CARGO	25000
RADAR SELECTION	MK 49(MOD)
MISSILES	NO MISSILES
TONS OF FUEL	1000 (300000 G)
LANDING CRAFT	3 LCACS
COMM. & CONTROL	LVL II (50 MEN)
GUNS	NO GUNS
SMALL AAW MISSILES	48
CIWS	2
CARGO ELEVATORS	1
TROOPS	200
VEHICLES	0
HOSPITAL BEDS	0
TONS OF FUEL	1000 (300000

SURVIVABILITY PARAMETERS	
ARRANGEMENT FACTOR	1.00
NBC PROTECTION IN %	0.50
SHOCK RESILENCE FACTOR	1.00
RCS REDUCTION IN DB	10.00
STACK EDUCTORS	YES
REDUNDANCY WEIGHT-AUX	0.00
REDUNDANCY WEIGHT-COMBAT	0.00
REDUNDANCY VOLUME-AUX	0.00
REDUNDANCY VOLUME-COMBAT	0.00
REDUNDANCY COST-AUX	0.00
REDUNDANCY COST-COMBAT	0.00
NO OF RAM PANELS	15.00
NO OF KEVLAR ARMOR PANELS	0.00
NO OF STEEL ARMOR PANELS	0.00
NO OF ALUMINUM ARMOR PANEL	0.00
PANEL WIDTHS	25.00
STEEL ARMOR THICKNESS	0.07
ALUMINUM ARMOR THICKNESS	0.00

***** MEASURES OF DESIGN EFFECTIVENESS *****
PAYLOAD/TOTAL SHIP COST RATIO = .2150211
MISSILES/$M = 0
LIFE CYCLE COST RATIO = ACQ.COST / (40 x O&S COST) = .4897818

COMBINATION OF TECHNOLOGIES
5-01 IR INSULATION
5-02 RCS REDUCTION - SLOPING SIDES + RAM
5-04 URN REDUCTION
5-06 EDUCTORS
9-04 BOW AND STERN BULB

(SEE PAGE 2 FOR LIST OF TECHNOLOGIES INCORPORATED)

SHIP MANNING MODEL

EXECUTIVE OFFICER MANNING................................	2
NAVIGATION OFFICER MANNING...............................	4
OPERATIONS OFFICER MANNING...............................	3
COMBAT SYSTEMS OFFICER MANNING...........................	2
ENGINEERING OFFICER MANNING..............................	3
SUPPLY OFFICER MANNING...................................	3
AVIATIONS OFFICER MANNING................................	3
EXECUTIVE ENLISTED MAN MANNING...........................	14
NAVIGATION ENLISTED MAN MANNING..........................	36
OPERATIONS ENLISTED MAN MANNING..........................	35
COMBAT SYSTEMS ENLISTED MAN MANNING......................	29
ENGINEERING ENLISTED MAN MANNING.........................	100
SUPPLY ENLISTED MAN MANNING..............................	75
AVIATION ENLISTED MAN MANNING............................	8

NUMBER OF OFFICERS OF = 20
NUMBER OF ENLISTED MEN EM = 297
TOTAL MANNING NC = 346.7

SHIP PROPULSION DATA

PROPELLER EFFICIENCY	NO =	.6471406
SHAFT HORSEPOWER	SHP =	93337.34
NO. OF PROPELLERS	NPP =	2
PROPELLER RPM	RPM =	99.6044
PROPELLER DIAMETER FT	DP =	25.63742

THESE RESULTS AT 28 KTS

COMMERCIAL COST OF AMPHIB SHIP

4TH SHIP COSTS . . .

	MATERIALS	LABOR HRS
HULL	1.427368E+07	547325.9
OPULSION	2.679261E+07	49859.86
ECTRICAL	7198382	719892.5
AUXILIARIES	3.194353E+07	424925
OUTFITTING	1.348329E+07	170263.8
SURVIVABILITY	0	0
WEAPONS/COMBAT SYS		282242.1
ENGINEERING		271891.2
SHIP ASSMBLY		960000
SUBTOTAL	9.852515E+07	3436600
x PROFITS, FEE, ETC	x 1.18877	x 1.18877
x LABOR COST		x 25.2
+ WEAPONS/COMBAT SYS	7.658125E+07	
TOTALS =	1.93705E+08	1.029503E+08

TOTAL COMMERCIAL COST = $ 2.966552E+08

AVERAGE TOTAL COMMERCIAL COST = $ 368.5353

APPENDIX C

MEDIUM CMD ASSET DATA

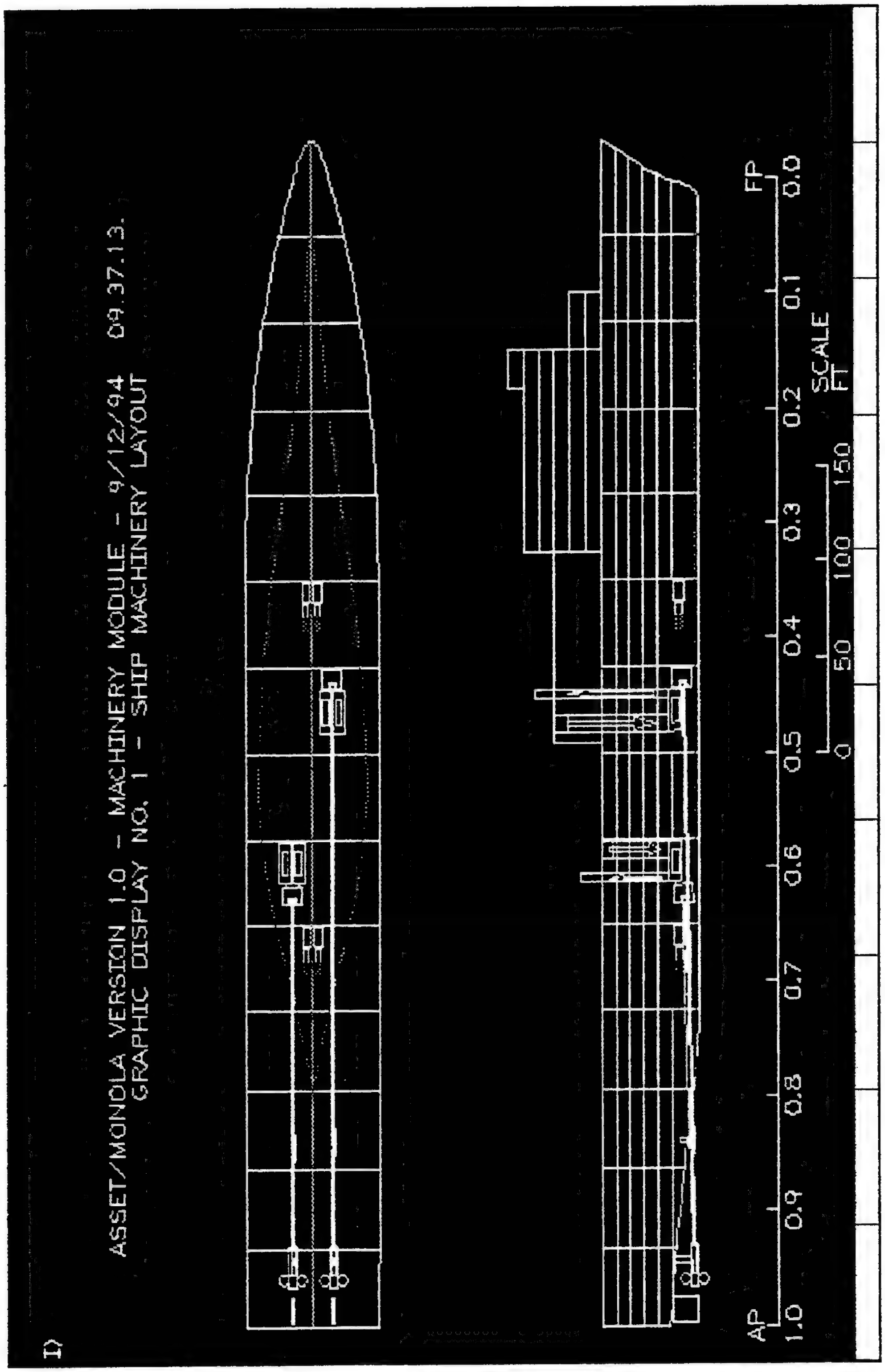
ALL OF SHIP 'CMD04' HAS BEEN USED.

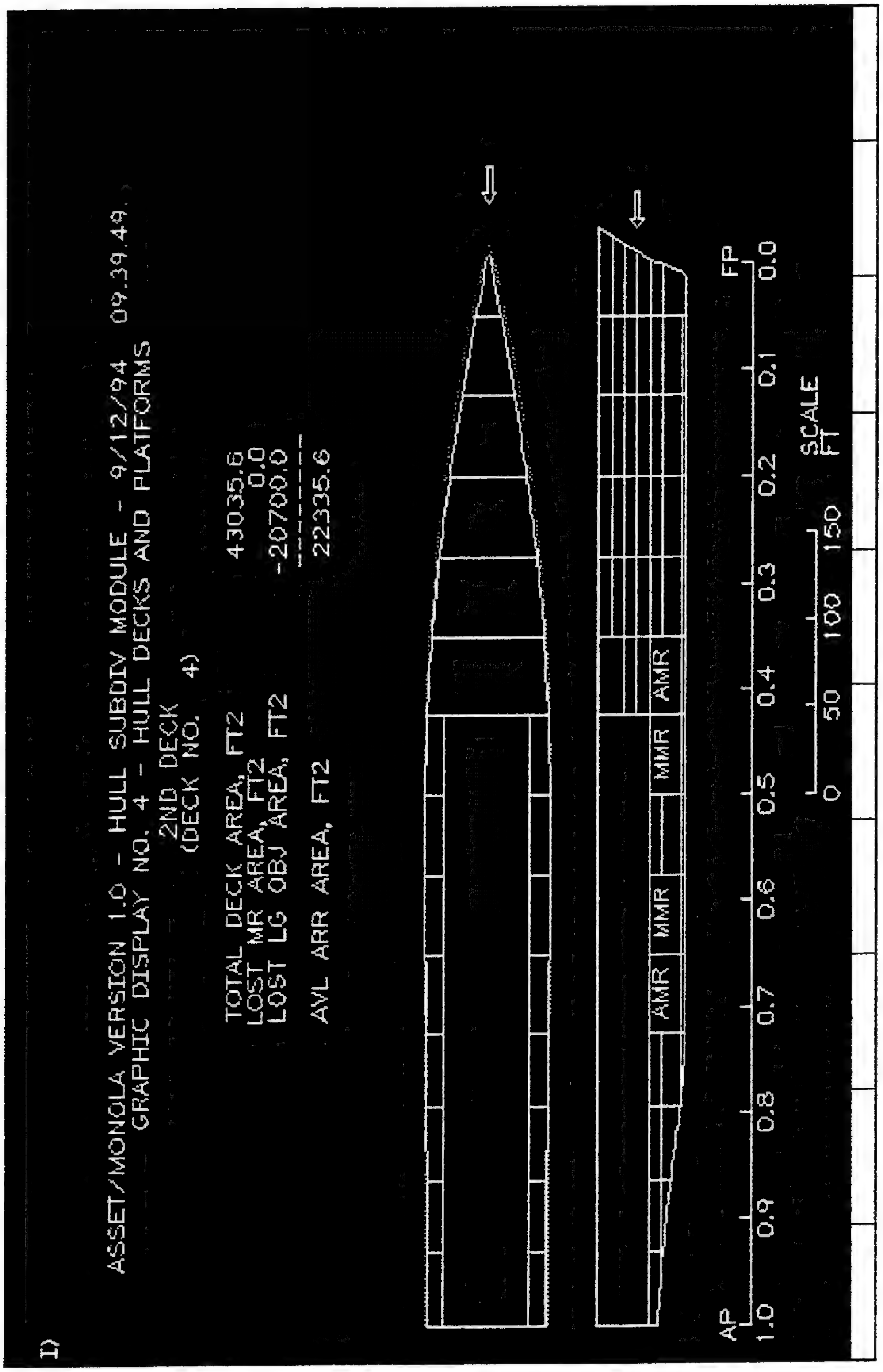
ASSET/MONOLA VERSION 1.0 - DESIGN SUMMARY - 9/16/94 12.25.18.

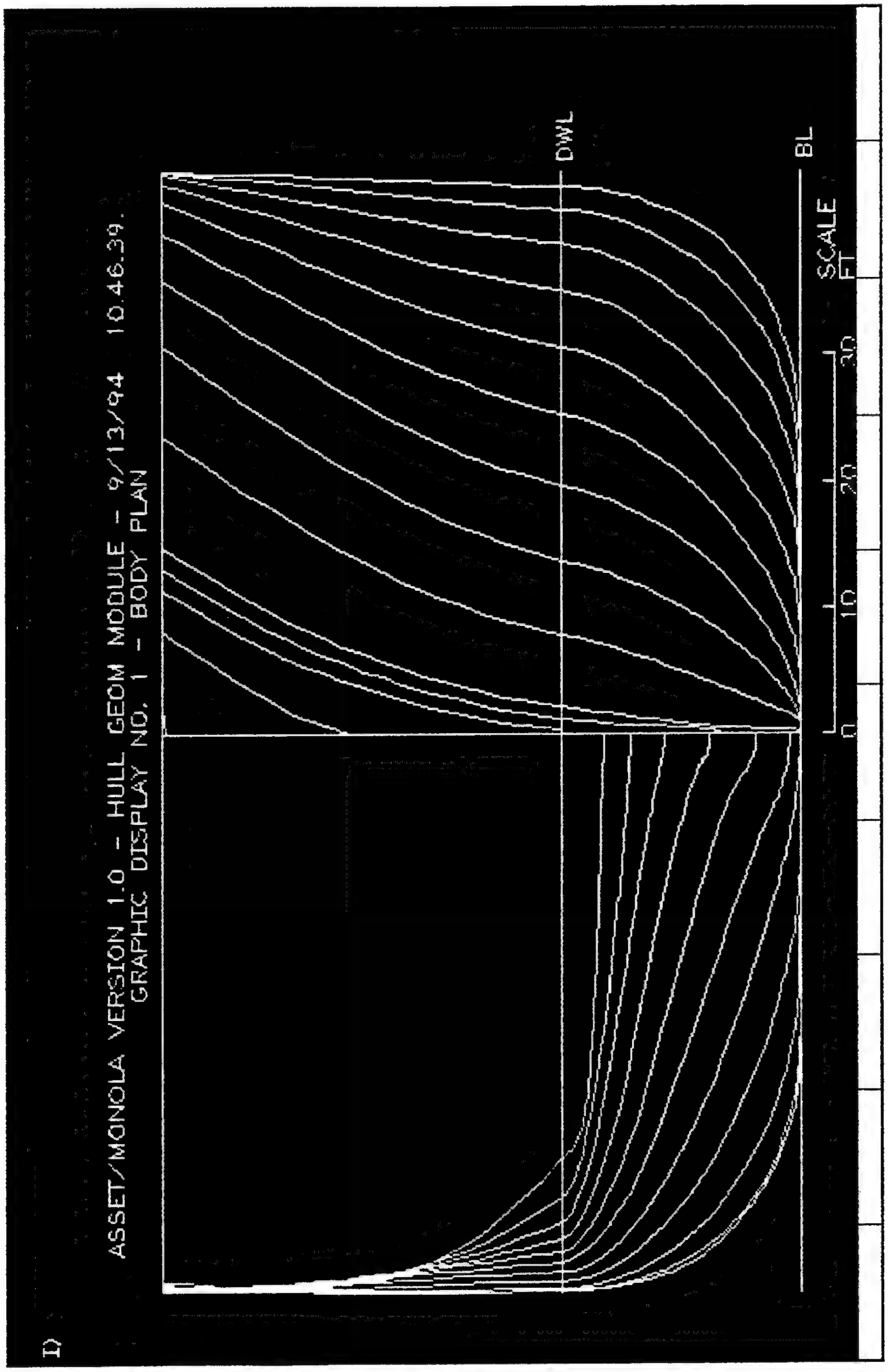
PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

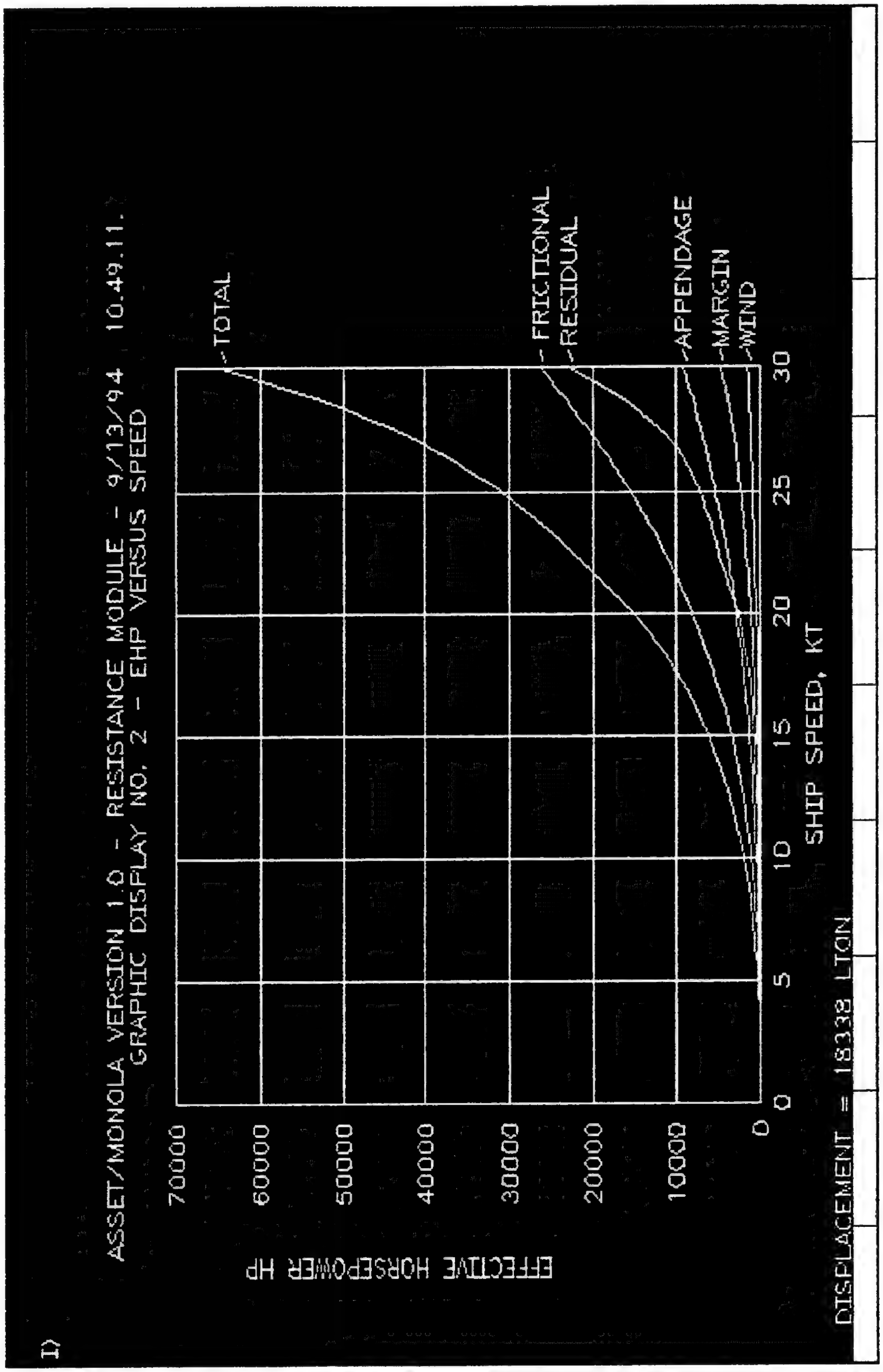
```
 PRINCIPAL CHARACTERISTICS - FT        WEIGHT SUMMARY - LTON
LBP                     600.0   GROUP 1 - HULL STRUCTURE   7649.2
LOA                     619.7   GROUP 2 - PROP PLANT       1818.2
BEAM, DWL                90.0   GROUP 3 - ELECT PLANT       611.2
BEAM, WEATHER DECK       90.0   GROUP 4 - COMM + SURVEIL    164.3
DEPTH @ STA 10           62.0   GROUP 5 - AUX SYSTEMS      1786.5
DRAFT TO KEEL DWL        23.8   GROUP 6 - OUTFIT + FURN    1106.7
DRAFT TO KEEL LWL        23.8   GROUP 7 - ARMAMENT           50.9
FREEBOARD @ STA 3        42.2   --------------------------------
GMT                       9.6   SUM GROUPS 1-7            13187.1
CP                      0.570   DESIGN MARGIN              1650.0
CX                      0.920   --------------------------------
                                LIGHTSHIP WEIGHT          14837.1
SPEED(KT): MAX= 27.6 SUST= 26.0 LOADS                      4572.9
ENDURANCE: 6000.0 NM AT 16.0 KTS --------------------------------
                                FULL LOAD DISPLACEMENT    19410.0
TRANSMISSION TYPE:       MECH   FULL LOAD KG: FT             37.0
MAIN ENG: 4 GT    @ 18200.0 HP
                                MILITARY PAYLOAD WT - LTON    0.0
SHAFT POWER/SHAFT: 35496.9 HP   USABLE FUEL WT - LTON      1742.0
PROPELLERS: 2 - CP  - 17.9 FT DIA
                                AREA SUMMARY - FT2
SEP GEN: 4 F DIESEL @ 2000.0 KW HULL AREA           - 142307.8
                                SUPERSTRUCTURE AREA -  72956.1
                                --------------------------------
24 HR LOAD              4015.6  TOTAL AREA             215263.9
MAX MARG ELECT LOAD    11946.3
                                VOLUME SUMMARY  - FT3
      OFF  CPO  ENL   TOTAL     HULL VOLUME           - 2407628.8
MANNING  49  33  386    468     SUPERSTRUCTURE VOLUME -  729561.1
ACCOM    52  35  418    505     --------------------------------
                                TOTAL VOLUME            3137189.8
```


ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 9/12/94 09.37.13.
GRAPHIC DISPLAY NO. 1 - SHIP MACHINERY LAYOUT
AP
FP
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
SCALE
FT
0
50
100
150


1)
ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 9/12/94 09.39.49.
GRAPHIC DISPLAY NO. 4 - HULL DECKS AND PLATFORMS
2ND DECK
(DECK NO. 4)
TOTAL DECK AREA, FT2 43035.6
LOST MR AREA, FT2 0.0
LOST LG OBJ AREA, FT2 -20700.0
AVL ARR AREA, FT2 22335.6
AMR
MMR
MMR
AMR
AP
FP
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
SCALE
FT
0
50
100
150


ASSET/MONOLA VERSION 1.0 - HULL GEOM MODULE - 9/13/94 10.46.39.
GRAPHIC DISPLAY NO. 1 - BODY PLAN
DWL
BL
SCALE
FT
0
10
20
30


ASSET/MONOLA VERSION 1.0 - DECKHOUSE MODULE - 9/13/94 10.48.12.
GRAPHIC DISPLAY NO. 2 - DECKHOUSE END VIEW
DWL
SCALE
FT
0 10 20 30



ASSET/MONOLA VERSION 1.0 - RESISTANCE MODULE - 9/13/94 10.49.11.
GRAPHIC DISPLAY NO. 2 - EHP VERSUS SPEED
EFFECTIVE HORSEPOWER HP
70000
60000
50000
40000
30000
20000
10000
0
0
5
10
15
20
25
30
SHIP SPEED, KT
TOTAL
FRICTIONAL
RESIDUAL
APPENDAGE
MARGIN
WIND
DISPLACEMENT = 18338 LTON

AIRCRAFT PAYLOAD MODEL 08-24-1994

TYPE AND NUMBER OF AIRCRAFT

CH-53D PROVISIONS FOR 2 SORTIES/DAY, 7 DAYS OF OPERATION

PROVISIONS EXPENDITURE FACTOR = .2
NUMBER OF CRANES = 1
NUMBER OF ELEVATORS = 0
NUMBER OF WIRES FOR ARRESTING GEAR = 0
NUMBER OF STEAM CATAPULTS = 0
FIN STABILIZERS = NO
HAUL DOWN SYSTEM = NO
SKI JUMP = NO
NUMBER OF SORTIES FOR EACH DAY = 0
NUMBER OF DAYS FOR DEPLOYMENT = 0
LENGTH OF LANDING DECK IN FEET = 300
WIDTH OF LANDING DECK IN FEET = 80
LENGTH OF TAKEOFF DECK IN FEET = 300
WIDTH OF TAKEOFF DECK IN FEET = 80
SAME DECK FOR TAKEOFFS AND LANDINGS
LANDING DECK/TAKEOFF DECK CONSTRUCTION AND MATERIALS = MILD STEEL
HANGER LOCATION IS ON DECK
HANGER CONSTRUCTION MATERIAL IS MILD STEEL

PROVISIONS MADE FOR THE FOLLOWING AIRCRAFT LOADS:

MAINTENANCE LEVEL I FOR HANGAR AREA
HANGAR LOCATION IS ON DECK
HANGAR CONSTRUCTION MATERIAL IS MILD STEEL
PERCENTAGE OF AIRCRAFT IN HANGAR = 50 % ,
LEADING TO 6491.654 SQFT HANGAR AREA
NUMBER OF CRANES = 1

WEIGHT SWBS	DESCRIPTION		WEIGHT, LT
42313	TACAN	=	0.55
4272	NAVIGATION ALIGNMENT SYSTEM	=	1.00
454	AIRCRAFT CONTROL APPROACH RADAR	=	11.46
492	FLIGHT CONTROL & INST. LANDING	=	6.00
533	GAS SYSTEM	=	0.00
542	JP-5 SYSTEMS	=	6.00
586	CRANE (AC & BOAT)	=	67.00
588	AIRCRAFT HANDLING SERVICE, STOWG	=	168.55
661	OFFICES	=	7.00
665	WORKSHOPS	=	22.50
672	STOREROOMS	=	16.00
782	WEAPONS HANDLING	=	0.86
783	WEAPONS STOWAGE	=	15.64
792	SPECIAL WEAPONS HANDLING/STOWAGE	=	0.00

****** AIRCRAFT SYSTEM (NO LOADS) ******

TOTAL WEIGHT OF AIRCRAFT SYSTEM IN TONS = 2524.61

****** MANNING ******

F16	NUMBER OF OFFICERS	=	7
F16	NUMBER OF CPO'S	=	4
F16	NUMBER OF ENLISTED MEN	=	22

AREA SWBS	DESCRIPTION		AREA, SQFT
1.32	AVIATION CONTROL AREA	=	620.00
1.3233	AVIATION PLAN & READY ROOM	=	620.00
1.35	AVIATION ADMINISTRATION AREA	=	638.00
1.351	AIR INTERMEDIATE MAINTENANCE DEPT	=	398.11
1.352	AIR DEPARTMENT	=	19.14
1.353	AIR WING (SQUADRON OFFICES)	=	220.75
1.36	AVIATION MAINTENANCE AREA	=	1928.00
1.361	AIRFRAME	=	158.10
1.362	AVIONICS MAINTENANCE AREA	=	848.32
1.3642	AVIATION JET MAINTENANCE SHOP	=	198.58
1.3649	AVIATION FUEL MAINTENANCE AREA	=	13.50
1.365	SURVIVAL EQUIPMENT	=	75.19
1.367	GROUND SUPPORT EQUIPMENT	=	113.75
1.369	ORGANIZATIONAL LEVEL FACILITIES	=	518.63
1.38	AVIATION FUEL SYSTEM AREA	=	444.00
1.39	AVIATION STORES AREA	=	185.00
1.3912	SD SR (AVIATION)	=	5.37
1.3921	AIRFRAME	=	68.82
1.3922	AVIONICS	=	30.53
1.3923	ORDNANCE	=	4.26
1.3924	POWERPLANT	=	19.98
1.394	FLIGHT CLOTHING	=	49.95
1.397	SQUADRON	=	6.11

TAL AREA OF AIRCRAFT SYSTEM IN SQUARE FEET = 3867

****** LOADS ******

F22	WEIGHT ORDNANCE LOAD IN TONS	=	0
F22	VOLUME ORDNANCE LOAD IN CUBIC FEET	=	0
F22	MAGAZINE ORDNANCE AREA IN SQUARE FEET	=	0
F23	AIRCRAFT WEIGHT, TONS	=	63.16072
F26	AIRCRAFT SPARES WEIGHT, TONS	=	25.26429
F29	SPECIAL LOADS WGT (SONOBOUYS,PODS), TONS	=	0
F29	SPECIAL LOADS VOL, CUBIC FEET	=	0
F42	JP-5 LOAD WEIGHT, TONS	=	224.25
F42	JP-5 VOLUME, CUBIC FEET	=	10062.5

TOTAL AIRCRAFT LOADS WEIGHT IN TONS = 287.4107
TOTAL AIRCRAFT LOADS VOLUME IN CUBIC FEET = 10062.5

PAYLOAD-LIMITED TECHNOLOGY ASSESSMENT 08-24-1994

SHIP TYPE -
..D MEDIUM VARIANT - CRP, MECHANICAL

SEE PAGE 2 FOR LIST OF TECHNOLOGIES INCORPORATED

MAIN ENGINES - 3 LM2500-30 GAS TURBINES
VERTICALLY MOUNTED EXHAUST WITH STACK
MECHANICAL TRANSMISSION
GENERATOR TYPE - LM500
STEEL SUPERSTRUCTURE
COMPENSATED FUEL SYSTEM

WEIGHT IN LONG TONS		VOLUME IN CUBIC FEET	
SHIP DISPLACEMENT	20900.43	SHIP VOLUME	3100287.00
HULL WEIGHT	9832.61	PROPULSION VOLUME	129843.40
SURVIVABILITY WEIGHT	25.50	ELECTRICAL VOLUME	71100.00
PROPULSION WEIGHT	482.00	PAYLOAD VOLUME	1458742.00
ELECTRICAL WEIGHT	524.44	AUXILIARY VOLUME	464729.20
PAYLOAD WEIGHT	4101.61	PERSONNEL VOLUME	296931.30
AUXILIARY WEIGHT	1702.03	REDUNDANCY VOLUME	0.00
OUTFITTNG WEIGHT	1204.66	OFFICES/SHOPS VOLUME	557675.00
REDUNDANCY WEIGHT	0.00	LOADS VOLUME	15685.15
FUEL WEIGHT	1704.04	FUEL VOLUME	74598.41
LOADS WEIGHT	731.47	MARGINS VOLUME	0.00
MARGINS WEIGHT	592.07		

POWER PLANT PARAMETERS		SHIP CHARACTERISTICS	
CRUISE BHP	10680.41	CREW SIZE	431.90
SUSTAINED BHP	60051.25	ACCOMMODATIONS	475.09
MAXIMUM BHP	74469.49	SHIP LENGTH FEET	677.74
INSTALLED BHP	75000.00	SHIP BEAM FEET	92.33
NO OF ENGINES	3	SHIP DRAFT FT	18.47
PROPULSION SFC	0.65	METACENTRIC HEIGHT FT	45.54
SUSTAINED SPEED KTS	26.27	CENTER OF GRAVITY FT	38.66
MAXIMUM SPEED KTS	27.81	GM INTACT STABILITY FT	6.88
CRUISE SPEED KNOTS	16.00	RANGE N.MI.	6000.00
MIN SUSTAINED SPEED KNO	24.00		
INSTALLED ELECTRIC KW	9000.00		
CRUISE ELECTRIC LOAD	3464.28		
NO OF GENERATORS	3		
GENERATOR SFC	0.82		

RANGE IN MILES		COST IN MILLIONS OF DOLLARS	
UNDERWATER NOISE RANGE	66.00	AVERAGE FIRST COST	560.32
IR DETECTION RANGE	4.59	O&S COST PER YEAR	30.57
RADAR DETECTION RANGE	250.00		

(SEE PAGE 2 FOR LIST OF TECHNOLOGIES INCORPORATED)

COMBAT PAYLOAD		SURVIVABILITY PARAMETERS	
CU FT OF CARGO	25000	ARRANGEMENT FACTOR	1.0
RADAR SELECTION	MK 49(MOD)	NBC PROTECTION IN %	0.5
MISSILES	NO MISSILES	SHOCK RESILENCE FACTOR	1.0
TONS OF FUEL	1000 (300000 G)	RCS REDUCTION IN DB	10.0
LANDING CRAFT	4 LCACS	STACK EDUCTORS	YES
COMM. & CONTROL	LVL II (50 MEN)	REDUNDANCY WEIGHT-AUX	0.0
GUNS	NO GUNS	REDUNDANCY WEIGHT-COMBAT	0.0
SMALL AAW MISSILES	48	REDUNDANCY VOLUME-AUX	0.0
CIWS	2	REDUNDANCY VOLUME-COMBAT	0.0
CARGO ELEVATORS	1	REDUNDANCY COST-AUX	0.0
TROOPS	200	REDUNDANCY COST-COMBAT	0.0
VEHICLES	0	NO OF RAM PANELS	15.0
HOSPITAL BEDS	0	NO OF KEVLAR ARMOR PANELS	0.0
TONS OF FUEL	1000 (300000	NO OF STEEL ARMOR PANELS	0.0
		NO OF ALUMINUM ARMOR PANEL	0.0
		PANEL WIDTHS	25.0
		STEEL ARMOR THICKNESS	0.0
		ALUMINUM ARMOR THICKNESS	0.0

***** MEASURES OF DESIGN EFFECTIVENESS *****
PAYLOAD/TOTAL SHIP COST RATIO = .1982806
MISSILES/$M = 0
LIFE CYCLE COST RATIO = ACQ.COST / (40 x O&S COST) = .4582927

COMBINATION OF TECHNOLOGIES
5-01 IR INSULATION
5-02 RCS REDUCTION - SLOPING SIDES + RAM
5-04 URN REDUCTION
5-06 EDUCTORS
9-04 BOW AND STERN BULB

(SEE PAGE 2 FOR LIST OF TECHNOLOGIES INCORPORATED)

SHIP MANNING MODEL

EXECUTIVE OFFICER MANNING	4
NAVIGATION OFFICER MANNING	8
OPERATIONS OFFICER MANNING	4
COMBAT SYSTEMS OFFICER MANNING	2
ENGINEERING OFFICER MANNING	6
SUPPLY OFFICER MANNING	6
AVIATIONS OFFICER MANNING	7
EXECUTIVE ENLISTED MAN MANNING	16
NAVIGATION ENLISTED MAN MANNING	42
OPERATIONS ENLISTED MAN MANNING	45
COMBAT SYSTEMS ENLISTED MAN MANNING	29
ENGINEERING ENLISTED MAN MANNING	116
SUPPLY ENLISTED MAN MANNING	85
AVIATION ENLISTED MAN MANNING	26

NUMBER OF OFFICERS OF = 37
NUMBER OF ENLISTED MEN EM = 359
TOTAL MANNING NC = 431.9

SHIP PROPULSION DATA

PROPELLER EFFICIENCY NO = .6471406
SHAFT HORSEPOWER SHP = 88709.72
NO. OF PROPELLERS NPP = 2
PROPELLER RPM RPM = 102.1694
PROPELLER DIAMETER FT DP = 24.99379
THESE RESULTS AT 28 KTS

COMMERCIAL COST OF AMPHIB SHIP

4TH SHIP COSTS . . .

	MATERIALS	LABOR HRS
HULL	1.647862E+07	629798.5
PROPULSION	2.704944E+07	51645.56
ELECTRICAL	7436049	748266.1
AUXILIARIES	3.532235E+07	477828.2
OUTFITTING	1.617927E+07	204598.2
SURVIVABILITY	0	0
WEAPONS/COMBAT SYS		303518.8
ENGINEERING		289139.6
SHIP ASSMBLY		1600000
SUBTOTAL	1.079326E+08	4314995
x PROFITS, FEE, ETC	x 1.18877	x 1.18877
x LABOR COST		x 25.2
+ WEAPONS/COMBAT SYS	8.059375E+07	
TOTALS =	2.089007E+08	1.292643E+08

TOTAL COMMERCIAL COST = $ 3.381651E+08

AVERAGE TOTAL COMMERCIAL COST = $ 417.9809

APPENDIX D

LARGE CMD ASSET DATA

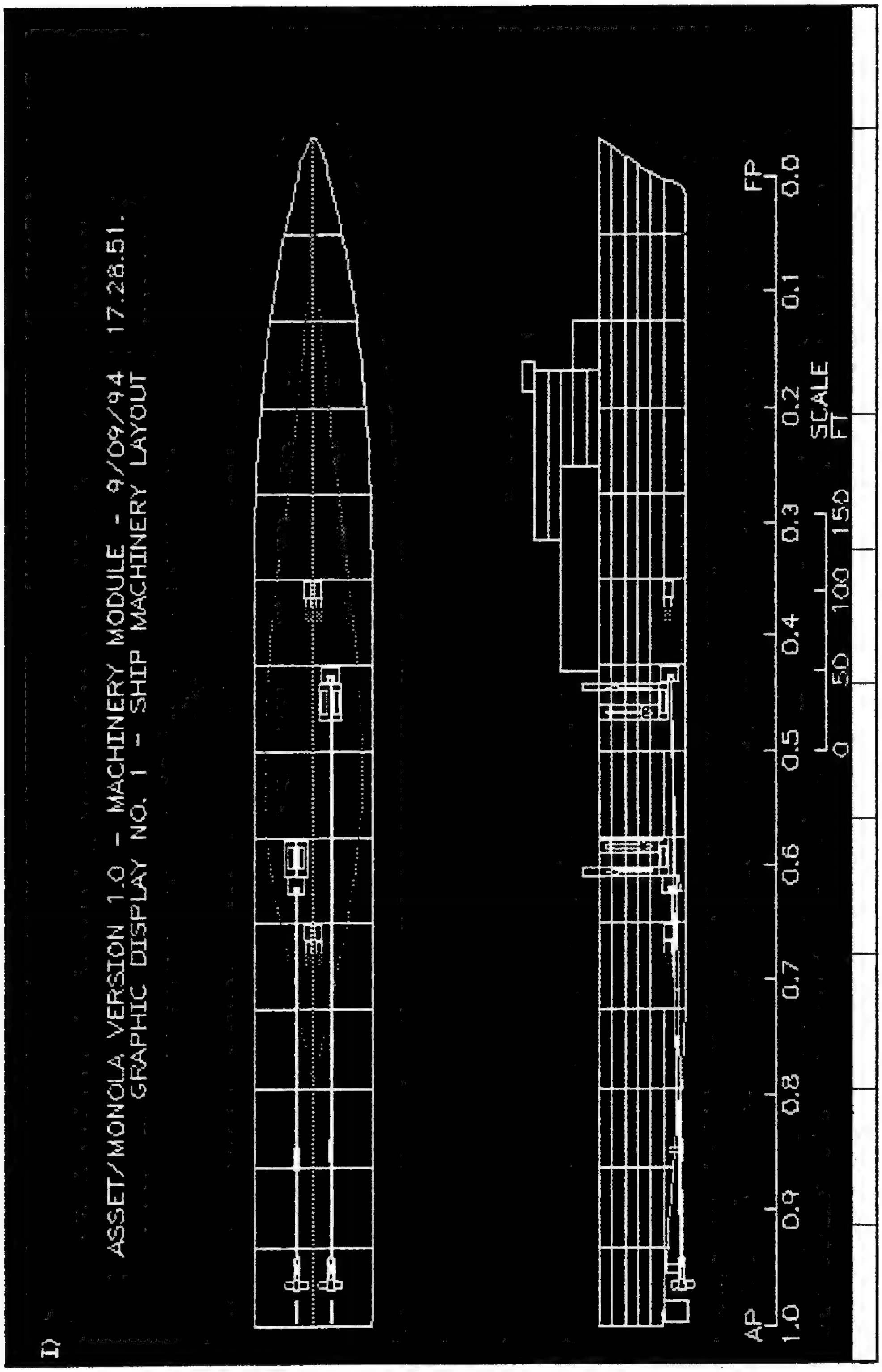
ALL OF SHIP 'CMD01' HAS BEEN USED.

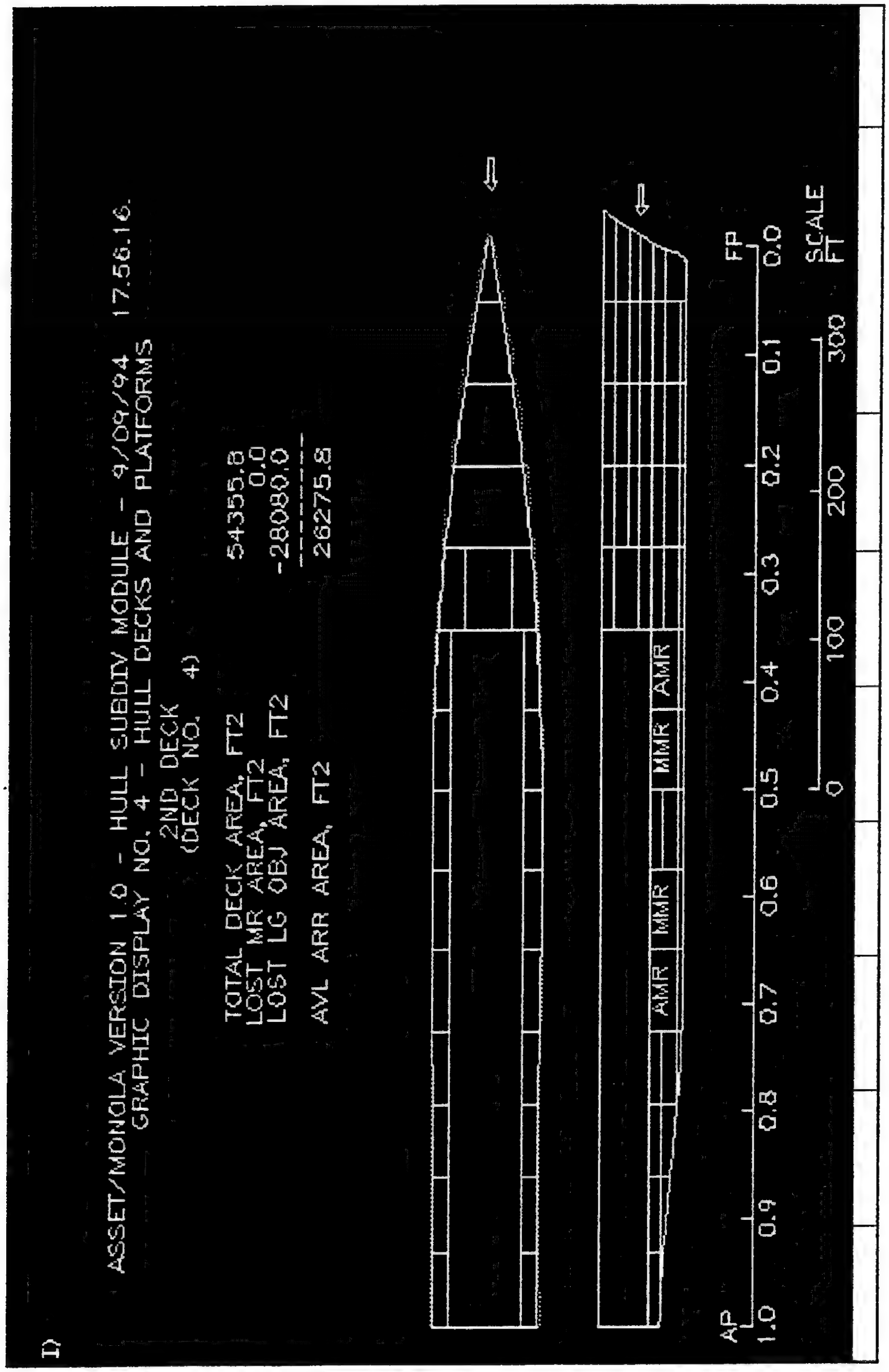
ASSET/MONOLA VERSION 1.0 - DESIGN SUMMARY - 9/16/94 12.48.46.

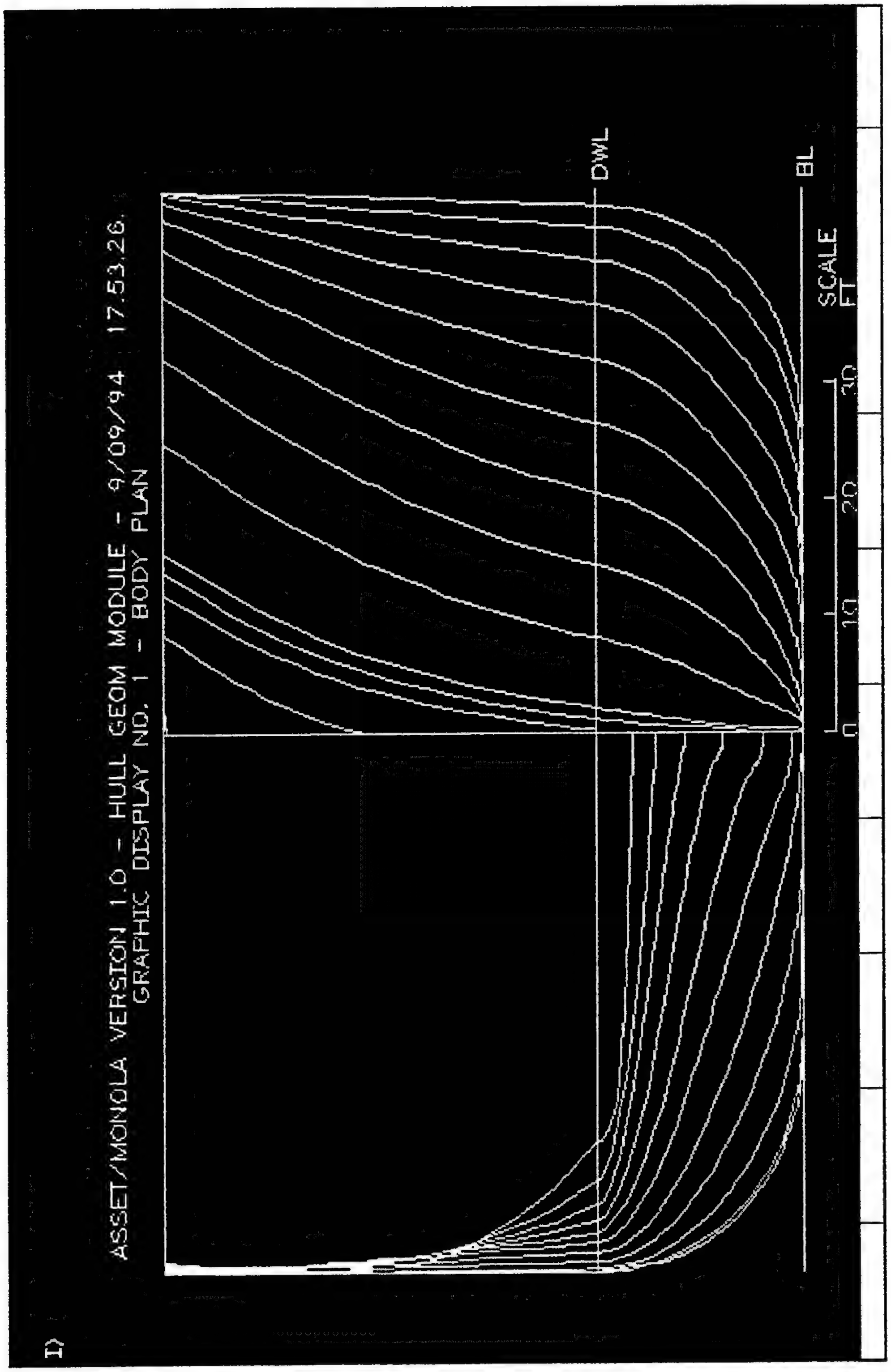
PRINTED REPORT NO. 1 - SUMMARY

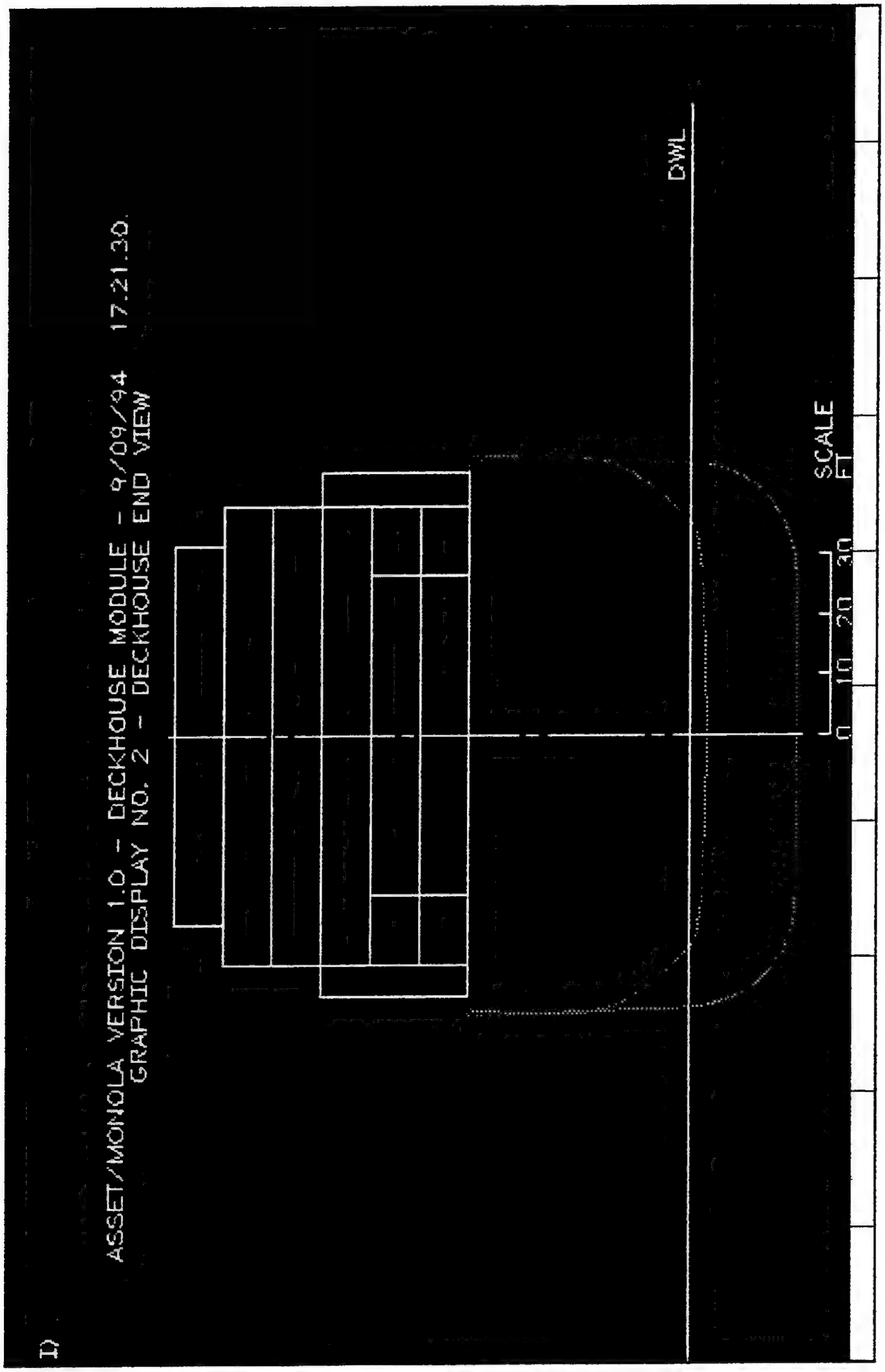
SHIP COMMENT TABLE

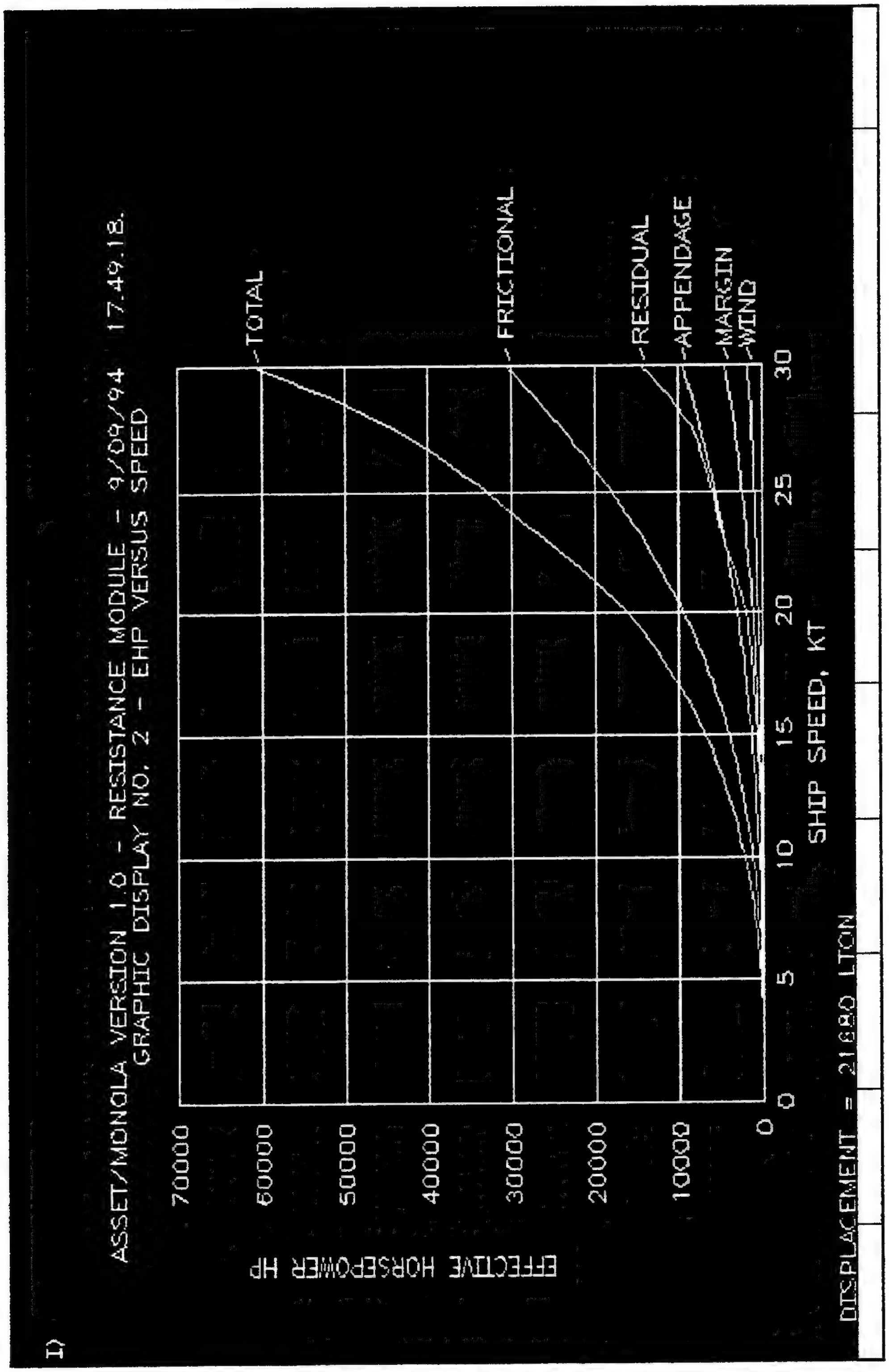
```
PRINCIPAL CHARACTERISTICS - FT          WEIGHT SUMMARY - LTON
LBP                   720.0   GROUP 1 - HULL STRUCTURE   9600.2
LOA                   743.6   GROUP 2 - PROP PLANT       1933.8
BEAM, DWL              92.0   GROUP 3 - ELECT PLANT       672.9
BEAM, WEATHER DECK     92.0   GROUP 4 - COMM + SURVEIL    199.9
DEPTH @ STA 10         67.0   GROUP 5 - AUX SYSTEMS      2439.5
DRAFT TO KEEL DWL      23.0   GROUP 6 - OUTFIT + FURN    1436.7
DRAFT TO KEEL LWL      23.0   GROUP 7 - ARMAMENT           50.9
FREEBOARD @ STA 3      48.0   --------------------------------
GMT                     9.1   SUM GROUPS 1-7            16334.0
CP                    0.570   DESIGN MARGIN              2043.7
CX                    0.920   --------------------------------
                              LIGHTSHIP WEIGHT          18377.7
SPEED(KT): MAX= 28.0 SUST= 26.0   LOADS                  4658.6
ENDURANCE: 6000.0 NM AT 16.0 KTS  ----------------------------
                              FULL LOAD DISPLACEMENT    23036.3
TRANSMISSION TYPE:      MECH   FULL LOAD KG: FT            39.6
MAIN ENG: 4 GT     @ 18802.1 HP
                              MILITARY PAYLOAD WT - LTON    0.0
SHAFT POWER/SHAFT:  36671.2 HP   USABLE FUEL WT - LTON   1941.9
PROPELLERS: 2 - CP  - 17.9 FT DIA
                              AREA SUMMARY - FT2
SEP GEN: 4 F DIESEL @ 2000.0 KW   HULL AREA          - 168321.8
                              SUPERSTRUCTURE AREA -  71502.3
                              ------------------------------
24 HR LOAD            5063.0   TOTAL AREA              239824.1
MAX MARG ELECT LOAD   15118.1
                              VOLUME SUMMARY  - FT3
        OFF  CPO  ENL  TOTAL   HULL VOLUME           - 3249325.3
MANNING  60   44  568   672    SUPERSTRUCTURE VOLUME -  715022.8
ACCOM    64   47  608   719    ------------------------------
                              TOTAL VOLUME            3964348.0
```


ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 9/09/94 17.28.51.
GRAPHIC DISPLAY NO. 1 - SHIP MACHINERY LAYOUT
AP
FP
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
SCALE
FT
0
50
100
150


ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 9/09/94 17.56.16.
GRAPHIC DISPLAY NO. 4 - HULL DECKS AND PLATFORMS
2ND DECK
(DECK NO. 4)
TOTAL DECK AREA, FT2 54355.8
LOST MR AREA, FT2 0.0
LOST LG OBJ AREA, FT2 -28080.0
AVL ARR AREA, FT2 26275.8
AMR
MMR
MMR
AMR
AP
FP
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
SCALE
FT
0
100
200
300


ASSET/MONOLA VERSION 1.0 - HULL GEOM MODULE - 9/09/94 17.53.26.
GRAPHIC DISPLAY NO. 1 - BODY PLAN
DWL
BL
SCALE
FT
0
10
20
30


ASSET/MONOLA VERSION 1.0 - DECKHOUSE MODULE - 9/09/94 17.21.30.
GRAPHIC DISPLAY NO. 2 - DECKHOUSE END VIEW
DWL
SCALE
FT
0 10 20 30


ASSET/MONOLA VERSION 1.0 - RESISTANCE MODULE - 9/09/94 17.49.18.
GRAPHIC DISPLAY NO. 2 - EHP VERSUS SPEED
EFFECTIVE HORSEPOWER HP
70000
60000
50000
40000
30000
20000
10000
0
0
5
10
15
20
25
30
SHIP SPEED, KT
TOTAL
FRICTIONAL
RESIDUAL
APPENDAGE
MARGIN
WIND
DISPLACEMENT = 21680 LTON

AIRCRAFT PAYLOAD MODEL 08-24-1994

TYPE AND NUMBER OF AIRCRAFT

CH-53D PROVISIONS FOR 2 SORTIES/DAY, 7 DAYS OF OPERATION

PROVISIONS EXPENDITURE FACTOR = .2
NUMBER OF CRANES = 1
NUMBER OF ELEVATORS = 0
NUMBER OF WIRES FOR ARRESTING GEAR = 0
NUMBER OF STEAM CATAPULTS = 0
FIN STABILIZERS = NO
HAUL DOWN SYSTEM = NO
SKI JUMP = NO
NUMBER OF SORTIES FOR EACH DAY = 0
NUMBER OF DAYS FOR DEPLOYMENT = 0
LENGTH OF LANDING DECK IN FEET = 400
WIDTH OF LANDING DECK IN FEET = 80
LENGTH OF TAKEOFF DECK IN FEET = 400
WIDTH OF TAKEOFF DECK IN FEET = 80
SAME DECK FOR TAKEOFFS AND LANDINGS
LANDING DECK/TAKEOFF DECK CONSTRUCTION AND MATERIALS = MILD STEEL
HANGER LOCATION IS ON DECK
HANGER CONSTRUCTION MATERIAL IS MILD STEEL

PROVISIONS MADE FOR THE FOLLOWING AIRCRAFT LOADS:

MAINTENANCE LEVEL I FOR HANGAR AREA
HANGAR LOCATION IS ON DECK
HANGAR CONSTRUCTION MATERIAL IS MILD STEEL
PERCENTAGE OF AIRCRAFT IN HANGAR = 50 %
LEADING TO 9402.759 SQFT HANGAR AREA
NUMBER OF CRANES = 1

WEIGHT SWBS	DESCRIPTION		WEIGHT, LT
42313	TACAN	=	0.55
4272	NAVIGATION ALIGNMENT SYSTEM	=	1.00
454	AIRCRAFT CONTROL APPROACH RADAR	=	12.55
492	FLIGHT CONTROL & INST. LANDING	=	6.00
533	GAS SYSTEM	=	0.00
542	JP-5 SYSTEMS	=	6.00
586	CRANE (AC & BOAT)	=	67.00
588	AIRCRAFT HANDLING SERVICE, STOWG	=	168.55
661	OFFICES	=	7.00
665	WORKSHOPS	=	36.50
672	STOREROOMS	=	20.00
782	WEAPONS HANDLING	=	1.44
783	WEAPONS STOWAGE	=	24.36
792	SPECIAL WEAPONS HANDLING/STOWAGE	=	0.00

****** AIRCRAFT SYSTEM (NO LOADS) ******

'OTAL WEIGHT OF AIRCRAFT SYSTEM IN TONS = 2761.27

****** MANNING ******

F16	NUMBER OF OFFICERS	= 11
F16	NUMBER OF CPO'S	= 7
F16	NUMBER OF ENLISTED MEN	= 111

AREA SWBS	DESCRIPTION	AREA, SQFT
1.32	AVIATION CONTROL AREA	= 1000.00
1.3233	AVIATION PLAN & READY ROOM	= 1000.00
1.35	AVIATION ADMINISTRATION AREA	= 1046.00
1.351	AIR INTERMEDIATE MAINTENANCE DEPT	= 652.70
1.352	AIR DEPARTMENT	= 31.38
1.353	AIR WING (SQUADRON OFFICES)	= 361.92
1.36	AVIATION MAINTENANCE AREA	= 3412.00
1.361	AIRFRAME	= 279.78
1.362	AVIONICS MAINTENANCE AREA	= 1501.28
1.3642	AVIATION JET MAINTENANCE SHOP	= 351.44
1.3649	AVIATION FUEL MAINTENANCE AREA	= 23.88
1.365	SURVIVAL EQUIPMENT	= 133.07
1.367	GROUND SUPPORT EQUIPMENT	= 201.31
1.369	ORGANIZATIONAL LEVEL FACILITIES	= 917.83
1.38	AVIATION FUEL SYSTEM AREA	= 518.00
1.39	AVIATION STORES AREA	= 493.00
1.3912	SD SR (AVIATION)	= 14.30
1.3921	AIRFRAME	= 183.40
1.3922	AVIONICS	= 81.35
1.3923	ORDNANCE	= 11.34
1.3924	POWERPLANT	= 53.24
1.394	FLIGHT CLOTHING	= 133.11
1.397	SQUADRON	= 16.27

TAL AREA OF AIRCRAFT SYSTEM IN SQUARE FEET = 6521

****** LOADS ******

F22	WEIGHT ORDNANCE LOAD IN TONS	= 0
F22	VOLUME ORDNANCE LOAD IN CUBIC FEET	= 0
F22	MAGAZINE ORDNANCE AREA IN SQUARE FEET	= 0
F23	AIRCRAFT WEIGHT, TONS	= 105.2679
F26	AIRCRAFT SPARES WEIGHT, TONS	= 42.10715
F29	SPECIAL LOADS WGT (SONOBOUYS,PODS), TONS	= 0
F29	SPECIAL LOADS VOL, CUBIC FEET	= 0
F42	JP-5 LOAD WEIGHT, TONS	= 373.75
F42	JP-5 VOLUME, CUBIC FEET	= 16770.83

TOTAL AIRCRAFT LOADS WEIGHT IN TONS = 479.0179
TOTAL AIRCRAFT LOADS VOLUME IN CUBIC FEET = 16770.83

PAYLOAD-LIMITED TECHNOLOGY ASSESSMENT 08-24-1994

SHIP TYPE - CMD LARGE VARIANT - CRP, MECHANICAL

SEE PAGE 2 FOR LIST OF TECHNOLOGIES INCORPORATED

MAIN ENGINES - 3 LM2500-30 GAS TURBINES
VERTICALLY MOUNTED EXHAUST WITH STACK
MECHANICAL TRANSMISSION
GENERATOR TYPE - LM500
STEEL SUPERSTRUCTURE
COMPENSATED FUEL SYSTEM

WEIGHT IN LONG TONS		VOLUME IN CUBIC FEET	
SHIP DISPLACEMENT	24143.01	SHIP VOLUME	3909947.00
HULL WEIGHT	11544.18	PROPULSION VOLUME	129843.40
SURVIVABILITY WEIGHT	25.50	ELECTRICAL VOLUME	71100.00
PROPULSION WEIGHT	491.75	PAYLOAD VOLUME	1845926.00
ELECTRICAL WEIGHT	560.02	AUXILIARY VOLUME	586197.10
PAYLOAD WEIGHT	4498.27	PERSONNEL VOLUME	432575.00
AUXILIARY WEIGHT	1986.21	REDUNDANCY VOLUME	0.00
OUTFITTNG WEIGHT	1534.41	OFFICES/SHOPS VOLUME	703436.50
REDUNDANCY WEIGHT	0.00	LOADS VOLUME	23863.10
FUEL WEIGHT	1780.06	FUEL VOLUME	77926.31
LOADS WEIGHT	1039.14	MARGINS VOLUME	0.00
MARGINS WEIGHT	683.47		

POWER PLANT PARAMETERS		SHIP CHARACTERISTICS	
CRUISE BHP	11631.83	CREW SIZE	629.20
SUSTAINED BHP	60006.56	ACCOMMODATIONS	692.12
MAXIMUM BHP	75721.15	SHIP LENGTH FEET	711.11
INSTALLED BHP	75000.00	SHIP BEAM FEET	96.88
NO OF ENGINES	3	SHIP DRAFT FT	19.38
PROPULSION SFC	0.64	METACENTRIC HEIGHT FT	47.78
SUSTAINED SPEED KTS	25.69	CENTER OF GRAVITY FT	40.56
MAXIMUM SPEED KTS	27.34	GM INTACT STABILITY FT	7.22
CRUISE SPEED KNOTS	16.00	RANGE N.MI.	6000.00
MIN SUSTAINED SPEED KNO	24.00		
INSTALLED ELECTRIC KW	9000.00		
CRUISE ELECTRIC LOAD	3478.02		
NO OF GENERATORS	3		
GENERATOR SFC	0.82		

RANGE IN MILES		COST IN MILLIONS OF DOLLARS	
UNDERWATER NOISE RANGE	66.00	AVERAGE FIRST COST	622.52
IR DETECTION RANGE	4.59	O&S COST PER YEAR	41.15
RADAR DETECTION RANGE	250.00		

(SEE PAGE 2 FOR LIST OF TECHNOLOGIES INCORPORATED)

COMBAT PAYLOAD		SURVIVABILITY PARAMETERS	
CU FT OF CARGO	25000	ARRANGEMENT FACTOR	1.0
RADAR SELECTION	MK 49 (MOD)	NBC PROTECTION IN %	0.5
MISSILES	NO MISSILES	SHOCK RESILENCE FACTOR	1.0
TONS OF FUEL	1000 (300000 G)	RCS REDUCTION IN DB	10.0
LANDING CRAFT	5 LCACS	STACK EDUCTORS	YES
COMM. & CONTROL	LVL III (75 MEN	REDUNDANCY WEIGHT-AUX	0.0
GUNS	NO GUNS	REDUNDANCY WEIGHT-COMBAT	0.0
SMALL AAW MISSILES	48	REDUNDANCY VOLUME-AUX	0.0
CIWS	2	REDUNDANCY VOLUME-COMBAT	0.0
CARGO ELEVATORS	3	REDUNDANCY COST-AUX	0.0
TROOPS	200	REDUNDANCY COST-COMBAT	0.0
VEHICLES	0	NO OF RAM PANELS	15.0
HOSPITAL BEDS	0	NO OF KEVLAR ARMOR PANELS	0.0
TONS OF FUEL	1000 (300000	NO OF STEEL ARMOR PANELS	0.0
		NO OF ALUMINUM ARMOR PANEL	0.0
		PANEL WIDTHS	25.0
		STEEL ARMOR THICKNESS	0.0
		ALUMINUM ARMOR THICKNESS	0.0

***** MEASURES OF DESIGN EFFECTIVENESS *****
PAYLOAD/TOTAL SHIP COST RATIO = .2061779
MISSILES/$M = 0
LIFE CYCLE COST RATIO = ACQ.COST / (40 x O&S COST) = .378207

COMBINATION OF TECHNOLOGIES
5-01 IR INSULATION
5-02 RCS REDUCTION - SLOPING SIDES + RAM
5-04 URN REDUCTION
5-06 EDUCTORS
9-04 BOW AND STERN BULB

(SEE PAGE 2 FOR LIST OF TECHNOLOGIES INCORPORATED)

SHIP MANNING MODEL

EXECUTIVE OFFICER MANNING	4
NAVIGATION OFFICER MANNING	8
OPERATIONS OFFICER MANNING	6
COMBAT SYSTEMS OFFICER MANNING	3
ENGINEERING OFFICER MANNING	6
SUPPLY OFFICER MANNING	6
AVIATIONS OFFICER MANNING	11
EXECUTIVE ENLISTED MAN MANNING	18
NAVIGATION ENLISTED MAN MANNING	49
OPERATIONS ENLISTED MAN MANNING	65
COMBAT SYSTEMS ENLISTED MAN MANNING	49
ENGINEERING ENLISTED MAN MANNING	136
SUPPLY ENLISTED MAN MANNING	97
AVIATION ENLISTED MAN MANNING	118

NUMBER OF OFFICERS OF = 44
NUMBER OF ENLISTED MEN EM = 532
TOTAL MANNING NC = 629.2

SHIP PROPULSION DATA

PROPELLER EFFICIENCY	NO =	.6471406
SHAFT HORSEPOWER	SHP =	96168.56
NO. OF PROPELLERS	NPP =	2
PROPELLER RPM	RPM =	98.12727
PROPELLER DIAMETER FT	DP =	26.02335

THESE RESULTS AT 28 KTS

COMMERCIAL COST OF AMPHIB SHIP

4TH SHIP COSTS . . .

	MATERIALS	LABOR HRS
HULL	1.943612E+07	740071.6
PROPULSION	2.724751E+07	53254.24
ELECTRICAL	7736879	783492.4
AUXILIARIES	3.980182E+07	549422.1
OUTFITTING	2.114222E+07	272680.4
SURVIVABILITY	0	0
WEAPONS/COMBAT SYS		332872.1
ENGINEERING		310760.4
SHIP ASSMBLY		1600000
SUBTOTAL	1.21731E+08	4652754
x PROFITS, FEE, ETC	x 1.18877	x 1.18877
x LABOR COST		x 25.2
+ WEAPONS/COMBAT SYS	9.310625E+07	
TOTALS =	2.378164E+08	1.393826E+08

TOTAL COMMERCIAL COST = $ 3.77199E+08

AVERAGE TOTAL COMMERCIAL COST = $ 465.0285

APPENDIX E

MOE RESULTS

1. Defense Efficiencies and Loss Probabilities for MOE Studies

A. Scenario #1 - Support of Amphibious Landing

SPECTRE Task Force

(1) Large CMD or (2) Med. CMD or (3) Small CMD
(4) Surface Strike PTX
(4) Surface MIW PTX
(2) Surface Patrol PTX
(2) Air Strike PTX
(4) Air MIW PTX
(1) Aegis Combatant
(2) LSD
(1) LHD
(14) Troop Carriers Airborne
(12) Troop Carriers Surface

Conventional Task Force

(4) Air Strike PTX
(4) Air MIW PTX
(1) Aegis Combatant
(2) LSD
(1) LHD
(14) Troop Carriers Airborne
(12) Troop Carriers Surface
(3) Surface Combatant
(1) SSN
(4) MHC

Opposing Threat

(10) shore launched ASMs
(200) anti ship shore fired gun projectiles
(200) anti air shore fired gun projectiles
(10) small ship launched ASMs
(50) small ship fired anti ship gun projectiles
(10) air launched anti-air missiles
(50) mines

Table E-1: Defense Efficiencies Scenario #1

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Ship Launch ASM	Ship Gun Anti Ship	Air Launch AAM	Mines
CMD	1.0	1.0	1.0	0.9	0.75	1.0	1.0
STRPTX/S	0.9	0.85	1.0	0.9	0.8	1.0	0.8
MIWPTX/S	0.85	0.8	1.0	0.85	0.8	1.0	0.95
PATPTX/S	0.9	0.95	1.0	0.9	0.95	1.0	0.8
STRPTX/A	1.0	1.0	0.9	1.0	1.0	0.9	1.0
MIWPTX/A	1.0	1.0	0.95	1.0	1.0	0.85	1.0
AEGIS	0.95	0.8	1.0	0.95	0.8	1.0	0.75
LSD	0.8	0.75	1.0	0.8	0.75	1.0	0.7
LHD	0.85	0.7	1.0	0.85	0.7	1.0	0.7
Troop Car/S	0.85	0.8	1.0	0.85	0.8	1.0	0.85
Troop Car/A	1.0	1.0	0.9	1.0	1.0	0.85	1.0
Surf Combat	0.9	0.8	1.0	0.9	0.8	1.0	0.75
SSN	1.0	1.0	1.0	1.0	1.0	1.0	0.75
MHC	0.85	0.8	1.0	0.85	0.8	1.0	0.95

Table E-2: Loss Probabilities Scenario #1

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Ship Launch ASM	Ship Gun Anti Ship	Air Launch AAM	Mines
CMD	0.0	0.0	0.0	0.15	0.05	0.0	0.0
STRPTX/S	0.3	0.15	0.0	0.3	0.1	0.0	0.3
MIWPTX/S	0.3	0.15	0.0	0.3	0.1	0.0	0.3
PATPTX/S	0.5	0.2	0.0	0.5	0.15	0.0	0.5
STRPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
MIWPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
AEGIS	0.2	0.05	0.0	0.2	0.03	0.0	0.25
LSD	0.2	0.05	0.0	0.2	0.03	0.0	0.2
LHD	0.15	0.05	0.0	0.15	0.03	0.0	0.15
Troop Car/S	0.5	0.2	0.0	0.5	0.15	0.0	0.5
Troop Car/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
Surf Combat	0.25	0.1	0.0	0.25	0.05	0.0	0.25
SSN	0.0	0.0	0.0	0.0	0.0	0.0	0.5
MHC	0.3	0.15	0.0	0.3	0.1	0.0	0.3

B. Scenario #2 - Support of Small Amphibious Landing

SPECTRE Task Force

(1) Large CMD or (1) Med. CMD or (3) Small CMD
(4) Surface Strike PTX
(4) Surface Patrol PTX

(4) Air Strike PTX
(2) Air MIW PTX
(2) Air ASW PTX
(1) LHD
(10) Troop Carriers Airborne
(4) Troop Carriers Surface

Conventional Task Force

(4) Air Strike PTX
(2) Air MIW PTX
(2) Air ASW PTX
(1) Aegis Combatant
(1) LHD
(4) Troop Carriers Airborne
(4) Troop Carriers Surface
(1) SSN
(2) MHC

Opposing Threat

(5) shore launched ASMs
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(5) small ship launched ASMs
(25) small ship fired anti ship gun projectiles
(5) air launched anti-air missiles
(25) mines

Table E-3: Defense Efficiencies Scenario #2

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Ship Launch ASM	Ship Gun Anti Ship	Air Launch AAM	Mines
CMD	1.0	1.0	1.0	0.9	0.75	1.0	1.0
STRPTX/S	0.95	0.85	1.0	0.95	0.8	1.0	0.8
PATPTX/S	0.9	0.95	1.0	0.9	0.95	1.0	0.8
STRPTX/A	1.0	1.0	0.9	1.0	1.0	0.9	1.0
MIWPTX/A	1.0	1.0	0.95	1.0	1.0	0.85	1.0
ASWPTX/A	1.0	1.0	0.95	1.0	1.0	0.85	1.0
AEGIS	0.95	0.8	1.0	0.95	0.8	1.0	0.75
LHD	0.85	0.7	1.0	0.85	0.7	1.0	0.7
Troop Car/S	0.85	0.8	1.0	0.85	0.8	1.0	0.85
Troop Car/A	1.0	1.0	0.9	1.0	1.0	0.85	1.0
SSN	1.0	1.0	1.0	1.0	1.0	1.0	0.75
MHC	0.85	0.8	1.0	0.85	0.8	1.0	0.95

Table E-4: Loss Probabilities Scenario #2

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Ship Launch ASM	Ship Gun Anti Ship	Air Launch AAM	Mines
CMD	0.0	0.0	0.0	0.15	0.05	0.0	0.0
STRPTX/S	0.3	0.15	0.0	0.3	0.1	0.0	0.3
PATPTX/S	0.5	0.2	0.0	0.5	0.15	0.0	0.5
STRPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
MIWPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
ASWPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
AEGIS	0.2	0.05	0.0	0.2	0.03	0.0	0.25
LHD	0.15	0.05	0.0	0.15	0.03	0.0	0.15
Troop Car/S	0.5	0.2	0.0	0.5	0.15	0.0	0.5
Troop Car/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
SSN	0.0	0.0	0.0	0.0	0.0	0.0	0.5
MHC	0.3	0.15	0.0	0.3	0.1	0.0	0.3

C. Scenario #3 - Blockade

SPECTRE Task Force

(1) Large CMD or (1) Med. CMD or (3) Small CMD
(6) Surface Strike PTX
(4) Surface Patrol PTX
(6) Air Strike PTX
(2) Air MIW PTX
(2) Air ASW PTX
(2) Air AAW PTX

Conventional Task Force

(2) Air Strike PTX
(2) Air MIW PTX
(2) Air ASW PTX
(2) Air AAW PTX
(4) Surface Combatant
(1) SSN

Opposing Threat

(5) shore launched ASMs
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(5) small ship launched ASMs

(25) small ship fired anti ship gun projectiles
(5) air launched anti-air missiles
(25) mines
(4) submarine launched anti ship missiles
(4) submarine launched torpedoes

Table E-5: Defense Efficiencies Scenario #3

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Ship Launch ASM	Ship Gun Anti Ship	Air Launch AAM	Mines	Sub Launch ASM	Sub Lanuch Torpedoes
CMD	1.0	1.0	1.0	0.9	0.75	1.0	1.0	0.9	0.7
STRPTX/S	0.95	0.85	1.0	0.95	0.8	1.0	0.8	0.95	0.8
PATPTX/S	0.9	0.95	1.0	0.9	0.95	1.0	0.8	0.9	0.9
STRPTX/A	1.0	1.0	0.9	1.0	1.0	0.9	1.0	1.0	1.0
MIWPTX/A	1.0	1.0	0.95	1.0	1.0	0.85	1.0	1.0	1.0
ASWPTX/A	1.0	1.0	0.95	1.0	1.0	0.85	1.0	1.0	1.0
AAWPTX/A	1.0	1.0	0.9	1.0	1.0	0.9	1.0	1.0	1.0
Surf Combat	0.9	0.8	1.0	0.9	0.8	1.0	0.75	0.9	0.7
SSN	1.0	1.0	1.0	1.0	1.0	1.0	0.75	1.0	0.7

Table E-6: Loss Probabilities Scenario #3

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Ship Launch ASM	Ship Gun Anti Ship	Air Launch AAM	Mines	Sub Launch ASM	Sub Lanuch Torpedoes
CMD	0.0	0.0	0.0	0.15	0.05	0.0	0.0	0.15	0.3
STRPTX/S	0.3	0.15	0.0	0.3	0.1	0.0	0.3	0.3	0.5
PATPTX/S	0.5	0.2	0.0	0.5	0.15	0.0	0.5	0.5	0.8
STRPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0
MIWPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0
ASWPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0
AAWPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.0	0.0
Surf Combat	0.25	0.1	0.0	0.25	0.05	0.0	0.25	0.25	0.3
SSN	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5

D. Scenario #4 - Mine Clearance

SPECTRE Task Force

(2) Large CMD or (2) Med. CMD or (6) Small CMD
(4) Surface Strike PTX
(8) Surface MIW PTX
(4) Air Strike PTX
(8) Air MIW PTX
(4) Air AAW PTX

Conventional Task Force

(4) Air Strike PTX
(8) Air MIW PTX
(4) Air AAW PTX
(1) LHD
(2) Surface Combatant
(6) MHC

Opposing Threat

(10) shore launched ASMs
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(10) air launched anti-air missiles
(10) air launched anti ship missiles
(50) mines

Table E-7: Defense Efficiencies Scenario #4

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Air Launch AAM	Air Launch ASM	Mines
CMD	1.0	1.0	1.0	1.0	0.9	1.0
STRPTX/S	0.9	0.85	1.0	1.0	0.9	0.8
MIWPTX/S	0.85	0.8	1.0	1.0	0.85	0.95
STRPTX/A	1.0	1.0	0.9	0.9	1.0	1.0
MIWPTX/A	1.0	1.0	0.95	0.85	1.0	1.0
AAWPTX/A	1.0	1.0	0.9	0.95	1.0	1.0
LHD	1.0	1.0	1.0	1.0	0.9	1.0
Surf Combat	0.9	0.8	1.0	1.0	0.9	0.75
MHC	0.85	0.8	1.0	1.0	0.85	0.95

Table E-8: Loss Probabilities Scenario #4

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Air Launch AAM	Air Launch ASM	Mines
CMD	0.0	0.0	0.0	0.0	0.15	0.0
STRPTX/S	0.3	0.15	0.0	0.0	0.3	0.3
MIWPTX/S	0.3	0.15	0.0	0.0	0.3	0.3
STRPTX/A	0.0	0.0	0.5	0.5	0.0	0.0
MIWPTX/A	0.0	0.0	0.5	0.5	0.0	0.0
AAWPTX/A	0.0	0.0	0.5	0.5	0.0	0.0
LHD	0.0	0.0	0.0	0.0	0.15	0.0
Surf Combat	0.25	0.1	0.0	0.0	0.25	0.25
MHC	0.3	0.15	0.0	0.0	0.3	0.3

E. Scenario #5 - Escort Operations

SPECTRE Task Force

(1) Large CMD or (1) Med. CMD or (3) Small CMD
(6) Surface Strike PTX
(4) Air Strike PTX
(2) Air MIW PTX
(4) Air AAW PTX
(1) Aegis Combatant

Conventional Task Force

(2) Air Strike PTX
(2) Air MIW PTX
(2) Air AAW PTX
(1) Aegis Combatant
(2) Surface Combatant

Opposing Threat

(5) shore launched ASMs
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(5) small ship launched ASMs
(25) small ship fired anti ship gun projectiles
(5) air launched anti-air missiles
(10) mines

Table E-9: Defense Efficiencies Scenario #5

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Ship Launch ASM	Ship Gun Anti Ship	Air Launch AAM	Mines
CMD	1.0	1.0	1.0	0.9	0.75	1.0	1.0
STRPTX/S	0.95	0.85	1.0	0.95	0.8	1.0	0.8
STRPTX/A	1.0	1.0	0.9	1.0	1.0	0.9	1.0
MIWPTX/A	1.0	1.0	0.95	1.0	1.0	0.85	1.0
AAWPTX/A	1.0	1.0	0.9	1.0	1.0	0.9	1.0
AEGIS	0.95	0.8	1.0	0.95	0.8	1.0	0.75
Surf Combat	0.9	0.8	1.0	0.9	0.8	1.0	0.75

Table E-10: Loss Probabilities Scenario #5

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Ship Launch ASM	Ship Gun Anti Ship	Air Launch AAM	Mines
CMD	0.0	0.0	0.0	0.15	0.05	0.0	0.0
STRPTX/S	0.3	0.15	0.0	0.3	0.1	0.0	0.3
STRPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
MIWPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
AAWPTX/A	0.0	0.0	0.5	0.0	0.0	0.5	0.0
AEGIS	0.2	0.05	0.0	0.2	0.03	0.0	0.25
Surf Combat	0.25	0.1	0.0	0.25	0.05	0.0	0.3

F. Scenario #6 - Special Operations

SPECTRE Task Force

(1) Large CMD or (2) Med. CMD or (3) Small CMD
(6) Surface Strike PTX
(6) Surface Patrol PTX
(4) Air Strike PTX
(4) Air AAW PTX

Conventional Task Force

(4) Air Strike PTX
(4) Air AAW PTX
(1) LHD
(2) PC

Opposing Threat

(10) shore launched ASMs
(100) anti ship shore fired gun projectiles
(100) anti air shore fired gun projectiles
(10) air launched anti-air missiles
(10) air launched anti ship missiles

Table E-11: Defense Efficiencies Scenario #6

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Air Launch AAM	Air Launch ASM
CMD	1.0	1.0	1.0	1.0	0.9
STRPTX/S	0.9	0.85	1.0	1.0	0.9
PATPTX/S	0.9	0.95	1.0	1.0	0.9
STRPTX/A	1.0	1.0	0.9	0.9	1.0
AAWPTX/A	1.0	1.0	0.9	0.95	1.0
LHD	1.0	1.0	1.0	1.0	0.9
PC	0.9	0.8	1.0	1.0	0.9

Table E-12: Loss Probabilities Scenario #6

	Shore Launch ASM	Shore Gun Anti Ship	Shore Gun Anti Air	Air Launch AAM	Air Launch ASM
CMD	0.0	0.0	0.0	0.0	0.15
STRPTX/S	0.3	0.15	0.0	0.0	0.3
PATPTX/S	0.5	0.2	0.0	0.0	0.5
STRPTX/A	0.0	0.0	0.5	0.5	0.0
AAWPTX/A	0.0	0.0	0.5	0.5	0.0
LHD	0.0	0.0	0.0	0.0	0.15
PC	0.3	0.15	0.0	0.0	0.3

APPENDIX F

ALTERNATIVE PROPULSION PLANT DATA

ALL OF SHIP 'CMD04' HAS BEEN USED.

ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 9/29/94 11.30.46.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	29.75
ELECT PRPLN TYPE IND	ACC-AC	SUSTN SPEED IND	CALC
SHAFT SUPPORT TYPE IND	OPEN STRUT	SUSTN SPEED, KT	28.29
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	16.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	13785.	ENDURANCE, NM	6000.
AVG 24 HR ELECT LOAD, KW	4641.	USABLE FUEL WT, LTON	1859.7
SWBS 200 GROUP WT, LTON	1024.7	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	957.5		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	4	4	2
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	2000. KW	2	1	0
VSCF SS CYCLO	1000. KW	4	4	2

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	GE-LM2500-30		MTU-16V538
ENG TYPE IND	GT		F DIESEL
ENG SIZE IND	GIVEN		GIVEN
NO INSTALLED	4	0	2
ENG PWR AVAIL, HP	26250.	.	3126.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.393		.345
ENG LOAD FRAC	1.000		.893

PRINTED REPORT NO. 3 - ENGINES

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG TYPE IND	GT		F DIESEL
ENG MODEL IND	GE-LM2500-30		MTU-16V538
ENG SIZE IND	GIVEN		GIVEN
NO INSTALLED	4	0	2
ENG BARE WT, LTON	3.1		6.6
ENG LENGTH, FT	15.65		10.37
ENG WIDTH, FT	5.20		5.38
ENG HEIGHT, FT	5.20		7.56
ENG PWR AVAIL, HP	26250.	.0	3126.3
ENG RPM	3600.0		1800.0
ENG MASS FL, LBM/SEC	135.5		8.3
ENG EXH TEMP, DEGF	1039.0		943.2
ENG SFC EQN IND	EXPNT		DIESEL
ENG SFC, LBM/HP-HR	0.393		.345

MAX SPEED CONDITION

NO OPERATING	4	0	1
ENG PWR, HP	26250.		4648.0
ENG RPM	3600.0		1800.0
ENG MASS FL, LBM/SEC	135.5		9.6
ENG EXH TEMP, DEGF	1039.0		1117.7
ENG SFC, LBM/HP-HR	.393		.352

SUSTN SPEED CONDITION

NO OPERATING	4	0	1
ENG PWR, HP	21468.		4648.0
ENG RPM	3374.5		1800.0
ENG MASS FL, LBM/SEC	125.4		9.6
ENG EXH TEMP, DEGF	991.3		1117.7
ENG SFC, LBM/HP-HR	.412		.352

ENDUR SPEED CONDITION

ENG ENDUR RPM IND	CALC		
NO OPERATING	2	0	0
ENG PWR, HP	9763.		.0
ENG RPM	2588.9		1800.0
ENG MASS FL, LBM/SEC	92.6		.0
ENG EXH TEMP, DEGF	876.8		
ENG SFC, LBM/HP-HR	.521		

NOTE - ENGINE OPERATING DATA ARE BASED ON USE OF DFM FUEL.

PRINTED REPORT NO. 7 - INTAKE DUCTS

INLET TYPE IND-PLENUM
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-84 DBA

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	GT	F DIESEL	
INLET DUCT XSECT AREA,FT2	99.6	.0	.0
INLET DUCT XSECT LTH, FT	11.45	.0	.0
INLET DUCT XSECT WID, FT	8.70	.0	.0

MMR1

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
INLET	0.8	88.00		
INLET DUCTING	3.5	54.20		
INLET SILENCER	2.8	40.34		
GT COOLING SUPPLY	3.6	41.85		
GT BLEED AIR SUPPLY	3.9	33.10		

MMR2

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
INLET	0.8	88.00		
INLET DUCTING	3.5	54.20		
INLET SILENCER	2.8	40.34		
GT COOLING SUPPLY	3.6	41.85		
GT BLEED AIR SUPPLY	3.9	33.10		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

	-----AREA,FT2----		---VOLUME,FT3----	
ENGINE CATEGORY	HULL	DKHS	HULL	DKHS
MAIN ENGINES	1912.8	1434.6	17215.	14346.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	0.0	0.0	0.	0.
TOTALS	1912.8	1434.6	17215.	14346.

PRINTED REPORT NO. 8 - EXHAUST DUCTS
EXHAUST IR SUPPRESS IND-PRESENT
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-84 DBA
EXHAUST STACK TEMP, DEGF 350.0
EDUCTOR DESIGN FAC 1.000

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	GT		F DIESEL
ENG EXH TEMP, DEG	1039.		905.
ENG MASS FL, LBM/SEC	135.5		7.9
EXH DUCT GAS TEMP, DEG	927.		905.
EXH DUCT GAS DEN, LBM/FT3	0.0282		.0286
EXH DUCT MASS FL, LBM/SEC	154.5		7.9
EXH DUCT AREA, FT2	51.0		2.6

MMR1

	----MAIN ENG----- WT,LTON	VCG,FT	-----SEC ENG----- WT,LTON	VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	15.0	54.20		
EXH SILENCER	11.2	48.67		
EXH STACK	3.0	98.30		
EXH SPRAY RING	1.3	65.73		
EXH EDUCTOR	13.7	101.81		

MMR2

	----MAIN ENG----- WT,LTON	VCG,FT	-----SEC ENG----- WT,LTON	VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	15.0	54.20		
EXH SILENCER	11.2	48.67		
EXH STACK	3.0	98.30		
EXH SPRAY RING	1.3	65.73		
EXH EDUCTOR	13.7	101.81		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

ENGINE CATEGORY	-----AREA,FT2---- HULL	DKHS	---VOLUME,FT3---- HULL	DKHS
MAIN ENGINES	2528.3	1896.3	22755.	18963.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	212.9	133.0	1916.	1330.
TOTALS	2741.2	2029.3	24671.	20293.

PRINTED REPORT NO. 9 - PROPELLERS AND SHAFTS

SHAFT SUPPORT TYPE IND-OPEN STRUT
SHAFT SYS SIZE IND-CALC
PROP TYPE IND-FP

PROP DIA, FT	19.15
HUB DIA, FT	3.66
PROP BLADE WT, LTON	11.4
PROP HUB WT, LTON	15.9
BEND STRESS CON FAC	1.000
OVRHG PROP MOM ARM RATIO	0.340
EQUIV FP PROP WT, LTON	27.3
ALLOW BEND STRESS, LBF/IN2	6000.
FATIGUE LIMIT, LBF/IN2	47500.
YIELD POINT, LBF/IN2	75000.
TORQUE MARGIN FAC	1.200
OFF-CENTER THRUST FAC	1.000
NO STRUTS PER SHAFT	2

PORT SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	3.54	3.54	3.54
LENGTH, FT	16.28	108.73	23.69
DIAMETER, FT	2.18	1.68	1.48
BORE RATIO	.550	.667	.667
WEIGHT, LTON	12.4	39.4	5.6
LCG, FT	592.73	530.34	464.25
TCG, FT	-14.02	-14.02	-14.02
VCG, FT	4.90	8.76	12.85
FACTOR OF SAFETY		2.00	1.75

STBD SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	3.54	3.54	3.54
LENGTH, FT	16.28	108.73	23.69
DIAMETER, FT	2.18	1.68	1.48
BORE RATIO	.550	.667	.667
WEIGHT, LTON	12.4	39.4	5.6
LCG, FT	592.73	530.34	464.25
TCG, FT	14.02	14.02	14.02
VCG, FT	4.90	8.76	12.85
FACTOR OF SAFETY		2.00	1.75

PRINTED REPORT NO. 14 - PROPULSION PLANT WEIGHT

SWBS	COMPONENT	WT,LTON	LCG,FT	VCG,FT
200	PROPULSION PLANT	1024.7	374.24	23.55
210	ENERGY GENERATING SYSTEM (NUCLEAR)	0.0	0.00	0.00
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)	0.0	0.00	0.00
230	PROPULSION UNITS	490.0	355.90	13.21
233	PROPULSION INTERNAL COMBUSTION ENGINES	0.0	0.00	0.00
234	PROPULSION GAS TURBINES	100.1	271.86	12.40
235	ELECTRIC PROPULSION	389.9	377.47	13.42
240	TRANSMISSION AND PROPULSOR SYSTEMS	216.8	545.89	7.80
241	PROPULSION REDUCTION GEARS	0.0	0.00	0.00
242	PROPULSION CLUTCHES AND COUPLINGS	0.0	0.00	0.00
243	PROPULSION SHAFTING	115.0	537.40	8.32
244	PROPULSION SHAFT BEARINGS	47.1	498.82	10.71
245	PROPULSORS	54.7	604.29	4.19
250	PRPLN SUPPORT SYS (EXCEPT FUEL+LUBE OIL)	253.7	278.79	59.59
251	COMBUSTION AIR SYSTEM	58.6	264.30	44.86
252	PROPULSION CONTROL SYSTEM	26.5	271.86	40.30
256	CIRCULATING AND COOLING SEA WATER SYSTEM	4.0	396.90	22.32
259	UPTAKES (INNER CASING)	164.6	282.22	68.85
260	PRPLN SUPPORT SYS (FUEL+LUBE OIL)	33.2	262.11	11.23
261	FUEL SERVICE SYSTEM	9.4	240.36	6.40
262	MAIN PROPULSION LUBE OIL SYSTEM	17.0	271.86	12.00
264	LUBE OIL FILL, TRANSFER, AND PURIF	6.8	267.86	16.00
290	SPECIAL PURPOSE SYSTEMS	31.0	365.21	15.16
298	OPERATING FLUIDS	20.5	378.00	8.00
299	REPAIR PARTS AND SPECIAL TOOLS	10.5	340.20	29.14

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 18 - MACHINERY SPACE REQUIREMENTS

MACHINERY ROOM VOLUME REQUIREMENTS

VOLUME CATEGORY	VOLUME, FT3
SWBS GROUP 200	176026.
PROPULSION POWER GENERATION	54143.
PROPULSION ENGINES	33861.
PROPULSION REDUCTION GEARS AND GENERATORS	20283.
DRIVELINE MACHINERY	17726.
REDUCTION AND BEVEL GEARS WITH Z-DRIVE	0.
ELECTRIC PROPULSION MOTORS AND GEARS	17726.
REMOTELY-LOCATED THRUST BEARINGS	0.
PROPELLER SHAFT	5072.
ELECTRIC PROPULSION MISCELLANEOUS EQUIPMENT	21894.
CONTROLS	2713.
BRAKING RESISTORS	2691.
MOTOR AND GENERATOR EXCITERS	4840.
SWITCHGEAR	2406.
POWER CONVERTERS	4333.
DEIONIZED COOLING WATER SYSTEMS	4912.
RECTIFIERS	0.
HELIUM REFRIGERATION SYSTEMS	0.
PROPULSION AUXILIARIES	77190.
PROPULSION LOCAL CONTROL CONSOLES	4738.
CP PROP HYDRAULIC OIL POWER MODULES	0.
FUEL OIL PUMPS	43696.
LUBE OIL PUMPS	4584.
LUBE OIL PURIFIERS	20091.
ENGINE LUBE OIL CONDITIONERS	1577.
SEAWATER COOLING PUMPS	2503.
SWBS GROUP 300	82419.
ELECTRIC PLANT POWER GENERATION	8630.
ELECTRIC PLANT ENGINES	4659.
ELECTRIC PLANT GENERATORS AND GEARS	3971.
SHIP SERVICE SWITCHBOARDS	70770.
CYCLOCONVERTERS	3019.
SWBS GROUP 500	91341.
AUXILIARY MACHINERY	91341.
AIR CONDITIONING PLANTS	10868.
AUXILIARY BOILERS	17957.
FIRE PUMPS	6541.
DISTILLING PLANTS	30463.
AIR COMPRESSORS	20520.
ROLL FIN PAIRS	0.
SEWAGE PLANTS	4993.

ARRANGEABLE AREA REQUIREMENTS

SSCS	GROUP NAME	----------FT2---------- HULL/DKHS	DKHS ONLY
4.31	AUXILIARY MACHINERY DELTA	-4906.3	0.0
4.3311	SHIP SERVICE POWER GENERATION	0.0	0.0
4.132	INTERNAL COMB ENG COMB AIR	0.0	0.0
4.133	INTERNAL COMB ENG EXHAUST	212.9	133.0
4.142	GAS TURBINE ENG COMB AIR	1912.8	1434.6
4.143	GAS TURBINE ENG EXHAUST	2528.3	1896.3

NOTE: * DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

ASSET/MONOLA VERSION 1.0 - SPACE MODULE - 9/29/94 11.30.57.

PRINTED REPORT NO. 6 - REQUIRED TANKAGE

POLLUTION CNTRL IND-PRESENT

ENDURANCE FUEL, FT3	109139.
AVIATION FUEL, FT3	0.
FRESH WATER, FT3	2752.
SEWAGE, FT3	1013.
WASTE OIL WATER, FT3	2183.
CLEAN BALLAST, FT3	30123.
TANKAGE MARGIN, FT3	0.

TANKAGE VOL REQ, FT3	145210.

ASSET/MONOLA VERSION 1.0 - DESIGN SUMMARY - 9/29/94 11.31.03.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

```
 PRINCIPAL CHARACTERISTICS - FT          WEIGHT SUMMARY - LTON
LBP                     630.0   GROUP 1 - HULL STRUCTURE  8417.8
LOA                     653.8   GROUP 2 - PROP PLANT      2261.8
BEAM, DWL                90.0   GROUP 3 - ELECT PLANT      330.9
BEAM, WEATHER DECK      103.2   GROUP 4 - COMM + SURVEIL   169.8
DEPTH @ STA 10           62.0   GROUP 5 - AUX SYSTEMS     1899.3
DRAFT TO KEEL DWL        24.4   GROUP 6 - OUTFIT + FURN   1185.2
DRAFT TO KEEL LWL        24.4   GROUP 7 - ARMAMENT          50.9
FREEBOARD @ STA 3        41.6   ------------------------------
GMT                       9.5   SUM GROUPS 1-7         14315.6
CP                      0.570   DESIGN MARGIN           1791.2
CX                      0.910   ------------------------------
                                LIGHTSHIP WEIGHT       16106.8
SPEED(KT): MAX= 29.7 SUST= 28.3 LOADS                   4572.9
ENDURANCE: 6000.0 NM AT 16.0 KTS ------------------------------
                                FULL LOAD DISPLACEMENT 20679.7
TRANSMISSION TYPE:        ELECT FULL LOAD KG: FT          38.4
MAIN ENG: 4 GT    @ 26250.0 HP
                                MILITARY PAYLOAD WT - LTON 0.0
SHAFT POWER/SHAFT: 44570.8 HP   USABLE FUEL WT - LTON   1859.7
PROPELLERS: 2 - FP - 19.2 FT DIA
                                AREA SUMMARY - FT2
SEP GEN: 2 F DIESEL @ 2000.0 KW HULL AREA           - 153094.7
PD GEN:  4 VSCF     @ 1000.0 KW SUPERSTRUCTURE AREA - 103967.0
                                ------------------------------
24 HR LOAD              4641.1  TOTAL AREA            257061.8
MAX MARG ELECT LOAD    13784.8
                                VOLUME SUMMARY - FT3
        OFF CPO ENL  TOTAL      HULL VOLUME          - 2657103.8
MANNING  49  33 386    468      SUPERSTRUCTURE VOLUME - 1036430.8
ACCOM    52  35 418    505      ------------------------------
                                TOTAL VOLUME           3693534.5
```

ALL OF SHIP 'CMD02' HAS BEEN USED.

ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 9/29/94 08.58.02.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	MECH	MAX SPEED, KT	30.22
ELECT PRPLN TYPE IND		SUSTN SPEED IND	CALC
SHAFT SUPPORT TYPE IND	OPEN STRUT	SUSTN SPEED, KT	28.84
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	16.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	14115.	ENDURANCE, NM	6000.
AVG 24 HR ELECT LOAD, KW	4748.	USABLE FUEL WT, LTON	1900.0
SWBS 200 GROUP WT, LTON	1037.5	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	1019.6		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
MECH PORT ARR IND	M2-LTDR	1	1	1
MECH STBD ARR IND	M2-LTDR	1	1	1
SEP SS GEN	2000. KW	4	3	2
VSCF SS CYCLO KW		0	0	0

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	GE-LM2500-30		MTU-16V538
ENG TYPE IND	GT		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	4	0	4
ENG PWR AVAIL, HP	26250.		2791.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.393		.349
ENG LOAD FRAC	1.000		1.000

PRINTED REPORT NO. 3 - ENGINES

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG TYPE IND	GT		F DIESEL
ENG MODEL IND	GE-LM2500-30		MTU-16V538
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	4	0	4
ENG BARE WT, LTON	3.1		5.7
ENG LENGTH, FT	15.65		9.85
ENG WIDTH, FT	5.20		5.11
ENG HEIGHT, FT	5.20		7.18
ENG PWR AVAIL, HP	26250.	.0	2790.9
ENG RPM	3600.0		1800.0
ENG MASS FL, LBM/SEC	135.5		7.5
ENG EXH TEMP, DEGF	1039.0		945.5
ENG SFC EQN IND	EXPNT		DIESEL
ENG SFC, LBM/HP-HR	0.393		.349

MAX SPEED CONDITION

NO OPERATING	4	0	3
ENG PWR, HP	26250.		4760.7
ENG RPM	3600.0		1800.0
ENG MASS FL, LBM/SEC	135.5		9.2
ENG EXH TEMP, DEGF	1039.0		1202.4
ENG SFC, LBM/HP-HR	.393		.356

SUSTN SPEED CONDITION

NO OPERATING	4	0	3
ENG PWR, HP	21000.		4760.7
ENG RPM	3374.5		1800.0
ENG MASS FL, LBM/SEC	124.3		9.2
ENG EXH TEMP, DEGF	986.8		1202.4
ENG SFC, LBM/HP-HR	.414		.356

ENDUR SPEED CONDITION

NO OPERATING	2	0	2
ENG PWR, HP	6400.		3313.0
ENG RPM	1789.7		1800.0
ENG MASS FL, LBM/SEC	78.7		8.0
ENG EXH TEMP, DEGF	845.8		1014.7
ENG SFC, LBM/HP-HR	.628		.356

NOTE - ENGINE OPERATING DATA ARE BASED ON USE OF DFM FUEL.

PRINTED REPORT NO. 7 - INTAKE DUCTS

INLET TYPE IND-PLENUM
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-90 DBA

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	GT		F DIESEL
INLET DUCT XSECT AREA,FT2	99.6	.0	.0
INLET DUCT XSECT LTH, FT	11.45	.0	.0
INLET DUCT XSECT WID, FT	8.70	.0	.0

MMR1

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
INLET	0.8	88.00		
INLET DUCTING	3.4	55.77		
INLET SILENCER	2.8	43.44		
GT COOLING SUPPLY	3.4	43.81		
GT BLEED AIR SUPPLY	3.9	35.39		

MMR2

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
INLET	0.8	88.00		
INLET DUCTING	3.4	55.78		
INLET SILENCER	2.8	43.44		
GT COOLING SUPPLY	3.4	43.81		
GT BLEED AIR SUPPLY	3.9	35.39		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

	-----AREA,FT2----		---VOLUME,FT3----	
ENGINE CATEGORY	HULL	DKHS	HULL	DKHS
MAIN ENGINES	1912.8	1434.6	17215.	14346.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	0.0	0.0	0.	0.
TOTALS	1912.8	1434.6	17215.	14346.

PRINTED REPORT NO. 8 - EXHAUST DUCTS

EXHAUST IR SUPPRESS IND-PRESENT
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-90 DBA
EXHAUST STACK TEMP, DEGF 350.0
EDUCTOR DESIGN FAC 1.000

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	GT		F DIESEL
ENG EXH TEMP, DEG	1039.		946.
ENG MASS FL, LBM/SEC	135.5		7.5
EXH DUCT GAS TEMP, DEG	927.		946.
EXH DUCT GAS DEN, LBM/FT3	0.0282		.0278
EXH DUCT MASS FL, LBM/SEC	154.5		7.5
EXH DUCT AREA, FT2	51.0		2.5

MMR1

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	14.4	55.72		
EXH SILENCER	11.2	51.77		
EXH STACK	3.0	98.30		
EXH SPRAY RING	1.3	66.76		
EXH EDUCTOR	13.7	101.81		

MMR2

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	14.4	55.71		
EXH SILENCER	11.2	51.77		
EXH STACK	3.0	98.30		
EXH SPRAY RING	1.3	66.76		
EXH EDUCTOR	13.7	101.81		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

	-----AREA,FT2----		---VOLUME,FT3----	
ENGINE CATEGORY	HULL	DKHS	HULL	DKHS
MAIN ENGINES	2528.3	1896.3	22755.	18963.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	418.9	261.8	3770.	2618.
TOTALS	2947.2	2158.1	26525.	21581.

PRINTED REPORT NO. 9 - PROPELLERS AND SHAFTS

SHAFT SUPPORT TYPE IND-OPEN STRUT	
SHAFT SYS SIZE IND-CALC	
PROP TYPE IND-CP	
PROP DIA, FT	17.63
HUB DIA, FT	6.19
PROP BLADE WT, LTON	13.2
PROP HUB WT, LTON	31.7
BEND STRESS CON FAC	1.700
OVRHG PROP MOM ARM RATIO	0.340
EQUIV FP PROP WT, LTON	33.8
ALLOW BEND STRESS, LBF/IN2	6000.
FATIGUE LIMIT, LBF/IN2	47500.
YIELD POINT, LBF/IN2	75000.
TORQUE MARGIN FAC	1.200
OFF-CENTER THRUST FAC	1.000
NO STRUTS PER SHAFT	2

PORT SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	.44	.44	.44
LENGTH, FT	14.98	153.94	77.28
DIAMETER, FT	2.86	1.80	1.55
BORE RATIO	.550	.667	.667
WEIGHT, LTON	19.7	63.4	20.1
LCG, FT	594.32	509.86	394.25
TCG, FT	-12.75	-12.75	-12.75
VCG, FT	5.92	6.56	7.45
FACTOR OF SAFETY		2.00	1.75

STBD SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	.33	.33	.33
LENGTH, FT	14.98	156.65	169.06
DIAMETER, FT	2.86	1.80	1.55
BORE RATIO	.550	.667	.667
WEIGHT, LTON	19.7	64.6	43.9
LCG, FT	594.32	508.50	345.65
TCG, FT	12.75	12.75	12.75
VCG, FT	5.90	6.39	7.31
FACTOR OF SAFETY		2.00	1.75

PRINTED REPORT NO. 14 - PROPULSION PLANT WEIGHT

SWBS	COMPONENT	WT,LTON	LCG,FT	VCG,FT
200	PROPULSION PLANT	1037.5	376.98	21.61
210	ENERGY GENERATING SYSTEM (NUCLEAR)	0.0	0.00	0.00
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)	0.0	0.00	0.00
230	PROPULSION UNITS	84.7	282.06	15.50
233	PROPULSION INTERNAL COMBUSTION ENGINES	0.0	0.00	0.00
234	PROPULSION GAS TURBINES	84.7	282.06	15.50
235	ELECTRIC PROPULSION	0.0	0.00	0.00
240	TRANSMISSION AND PROPULSOR SYSTEMS	584.9	437.09	7.32
241	PROPULSION REDUCTION GEARS	167.8	302.34	9.09
242	PROPULSION CLUTCHES AND COUPLINGS	0.0	0.00	0.00
243	PROPULSION SHAFTING	231.2	482.67	6.62
244	PROPULSION SHAFT BEARINGS	72.2	424.99	7.00
245	PROPULSORS	113.6	551.13	6.31
250	PRPLN SUPPORT SYS (EXCEPT FUEL+LUBE OIL)	260.4	292.43	59.68
251	COMBUSTION AIR SYSTEM	57.5	274.52	46.86
252	PROPULSION CONTROL SYSTEM	28.2	282.06	40.30
256	CIRCULATING AND COOLING SEA WATER SYSTEM	12.6	396.90	22.32
259	UPTAKES (INNER CASING)	162.2	292.45	70.49
260	PRPLN SUPPORT SYS (FUEL+LUBE OIL)	46.6	274.79	12.41
261	FUEL SERVICE SYSTEM	9.4	250.56	9.50
262	MAIN PROPULSION LUBE OIL SYSTEM	26.6	282.06	12.00
264	LUBE OIL FILL, TRANSFER, AND PURIF	10.6	278.06	16.00
290	SPECIAL PURPOSE SYSTEMS	60.9	371.49	11.64
298	OPERATING FLUIDS	50.4	378.00	8.00
299	REPAIR PARTS AND SPECIAL TOOLS	10.5	340.20	29.14

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 18 - MACHINERY SPACE REQUIREMENTS

MACHINERY ROOM VOLUME REQUIREMENTS

VOLUME CATEGORY	VOLUME, FT3
SWBS GROUP 200	144381.
PROPULSION POWER GENERATION	41382.
PROPULSION ENGINES	31651.
PROPULSION REDUCTION GEARS AND GENERATORS	9731.
DRIVELINE MACHINERY	0.
REDUCTION AND BEVEL GEARS WITH Z-DRIVE	0.
ELECTRIC PROPULSION MOTORS AND GEARS	0.
REMOTELY-LOCATED THRUST BEARINGS	0.
PROPELLER SHAFT	17159.
ELECTRIC PROPULSION MISCELLANEOUS EQUIPMENT	0.
CONTROLS	0.
BRAKING RESISTORS	0.
MOTOR AND GENERATOR EXCITERS	0.
SWITCHGEAR	0.
POWER CONVERTERS	0.
DEIONIZED COOLING WATER SYSTEMS	0.
RECTIFIERS	0.
HELIUM REFRIGERATION SYSTEMS	0.
PROPULSION AUXILIARIES	85840.
PROPULSION LOCAL CONTROL CONSOLES	4658.
CP PROP HYDRAULIC OIL POWER MODULES	6480.
FUEL OIL PUMPS	42952.
LUBE OIL PUMPS	5826.
LUBE OIL PURIFIERS	19750.
ENGINE LUBE OIL CONDITIONERS	1550.
SEAWATER COOLING PUMPS	4624.
SWBS GROUP 300	73815.
ELECTRIC PLANT POWER GENERATION	16535.
ELECTRIC PLANT ENGINES	8592.
ELECTRIC PLANT GENERATORS AND GEARS	7943.
SHIP SERVICE SWITCHBOARDS	57280.
CYCLOCONVERTERS	0.
SWBS GROUP 500	89787.
AUXILIARY MACHINERY	89787.
AIR CONDITIONING PLANTS	10683.
AUXILIARY BOILERS	17651.
FIRE PUMPS	6430.
DISTILLING PLANTS	29945.
AIR COMPRESSORS	20171.
ROLL FIN PAIRS	0.
SEWAGE PLANTS	4908.

ARRANGEABLE AREA REQUIREMENTS

SSCS	GROUP NAME	----------FT2---------- HULL/DKHS	DKHS ONLY
4.31	AUXILIARY MACHINERY DELTA	-1582.5	0.0
4.3311	SHIP SERVICE POWER GENERATION	0.0	0.0
4.132	INTERNAL COMB ENG COMB AIR	0.0	0.0
4.133	INTERNAL COMB ENG EXHAUST	418.9	261.8
4.142	GAS TURBINE ENG COMB AIR	1912.8	1434.6
4.143	GAS TURBINE ENG EXHAUST	2528.3	1896.3

ASSET/MONOLA VERSION 1.0 - SPACE MODULE - 9/29/94 08.58.14.

PRINTED REPORT NO. 6 - REQUIRED TANKAGE

POLLUTION CNTRL IND-PRESENT

ENDURANCE FUEL, FT3	109139.
AVIATION FUEL, FT3	0.
FRESH WATER, FT3	2752.
SEWAGE, FT3	1013.
WASTE OIL WATER, FT3	2183.
CLEAN BALLAST, FT3	30123.
TANKAGE MARGIN, FT3	0.

TANKAGE VOL REQ, FT3	145210.

ASSET/MONOLA VERSION 1.0 - DESIGN SUMMARY - 9/29/94 08.58.20.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PRINCIPAL CHARACTERISTICS - FT   WEIGHT SUMMARY - LTON

LBP 630.0 GROUP 1 - HULL STRUCTURE 8503.3
LOA 653.8 GROUP 2 - PROP PLANT 2512.9
BEAM, DWL 90.0 GROUP 3 - ELECT PLANT 619.8
BEAM, WEATHER DECK 103.1 GROUP 4 - COMM + SURVEIL 169.8
DEPTH @ STA 10 62.0 GROUP 5 - AUX SYSTEMS 1891.9
DRAFT TO KEEL DWL 25.0 GROUP 6 - OUTFIT + FURN 1184.8
DRAFT TO KEEL LWL 24.9 GROUP 7 - ARMAMENT 50.9
FREEBOARD @ STA 3 41.1 ---------------------------------
GMT 9.3 SUM GROUPS 1-7 14933.5
CP 0.570 DESIGN MARGIN 1868.5
CX 0.920 ---------------------------------
LIGHTSHIP WEIGHT 16802.0
SPEED(KT): MAX= 30.2 SUST= 28.8 LOADS 4572.9
ENDURANCE: 6000.0 NM AT 16.0 KTS ---------------------------------
FULL LOAD DISPLACEMENT 21374.9
TRANSMISSION TYPE: MECH FULL LOAD KG: FT 37.8
MAIN ENG: 4 GT @ 26250.0 HP
MILITARY PAYLOAD WT - LTON 0.0
SHAFT POWER/SHAFT: 51197.3 HP USABLE FUEL WT - LTON 1900.0
PROPELLERS: 2 - CP - 17.6 FT DIA
AREA SUMMARY - FT2
SEP GEN: 4 F DIESEL @ 2000.0 KW HULL AREA - 160288.3
SUPERSTRUCTURE AREA - 103963.0
----
24 HR LOAD 4748.3 TOTAL AREA 264251.3
MAX MARG ELECT LOAD 14115.5
VOLUME SUMMARY - FT3

	OFF	CPO	ENL	TOTAL
MANNING	49	33	386	468
ACCOM	52	35	418	505

HULL VOLUME - 2651982.0
SUPERSTRUCTURE VOLUME - 1036390.8

TOTAL VOLUME 3688372.8

ALL OF SHIP 'CMD03' HAS BEEN USED.

ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 9/29/94 08.58.38.

PRINTED REPORT NO. 1 - SUMMARY

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TRANS TYPE IND              MECH   MAX SPEED, KT           25.35
ELECT PRPLN TYPE IND               SUSTN SPEED IND          CALC
SHAFT SUPPORT TYPE IND OPEN STRUT  SUSTN SPEED, KT          23.58
NO PROP SHAFTS              2.     ENDUR SPEED IND          GIVEN
ENDUR CONFIG IND            NO TS  ENDUR SPEED, KT          16.00
SEC ENG USAGE IND                  DESIGN MODE IND          ENDURANCE
MAX MARG ELECT LOAD, KW     14020. ENDURANCE, NM            6000.
AVG 24 HR ELECT LOAD, KW    4638.  USABLE FUEL WT, LTON     1130.7
SWBS 200 GROUP WT, LTON     1081.6 SUSTN SPEED POWER FRAC   0.80
SWBS 300 GROUP WT, LTON     1024.2
                                 NO       NO ONLINE  NO ONLINE
ARRANGEMENT OR SS GEN     TYPE   INSTALLED MAX+SUSTN  ENDURANCE
------------------------ ---------- --------- --------- ---------
MECH PORT ARR IND         M2-LTDR    1         1         1
MECH STBD ARR IND         M2-LTDR/F  1         1         1
SEP SS GEN            2000. KW       4         3         2
VSCF SS CYCLO               KW       0         0         0

                    MAIN ENG      SEC ENG      SS ENG
                 -------------- -------------- --------------
ENG SELECT IND         GIVEN                     GIVEN
ENG MODEL IND        F-PC2/18-DD                 MTU-16V538
ENG TYPE IND         D DIESEL                    F DIESEL
ENG SIZE IND           GIVEN                     CALC
NO INSTALLED             4             0          4
ENG PWR AVAIL, HP      11700.          .         2791.
ENG RPM              520.0                       1800.0
ENG SFC, LBM/HP-HR     0.340                      .349
ENG LOAD FRAC          1.000                     1.000
```

PRINTED REPORT NO. 3 - ENGINES

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG TYPE IND	D DIESEL		F DIESEL
ENG MODEL IND	F-PC2/18-DD		MTU-16V538
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	4	0	4
ENG BARE WT, LTON	87.1		5.7
ENG LENGTH, FT	30.43		9.85
ENG WIDTH, FT	12.15		5.11
ENG HEIGHT, FT	12.76		7.18
ENG PWR AVAIL, HP	11700.	.0	2790.9
ENG RPM	520.0		1800.0
ENG MASS FL, LBM/SEC	37.8		7.5
ENG EXH TEMP, DEGF	750.0		945.5
ENG SFC EQN IND	DIESEL		DIESEL
ENG SFC, LBM/HP-HR	0.340		.349

MAX SPEED CONDITION

NO OPERATING	4	0	3
ENG PWR, HP	11700.		4656.7
ENG RPM	520.0		1800.0
ENG MASS FL, LBM/SEC	37.8		9.1
ENG EXH TEMP, DEGF	750.0		1188.1
ENG SFC, LBM/HP-HR	.340		.356

SUSTN SPEED CONDITION

NO OPERATING	4	0	3
ENG PWR, HP	9360.		4656.7
ENG RPM	482.8		1800.0
ENG MASS FL, LBM/SEC	34.7		9.1
ENG EXH TEMP, DEGF	692.8		1188.1
ENG SFC, LBM/HP-HR	.334		.356

ENDUR SPEED CONDITION

NO OPERATING	2	0	2
ENG PWR, HP	5824.		3235.7
ENG RPM	320.0		1800.0
ENG MASS FL, LBM/SEC	28.9		7.9
ENG EXH TEMP, DEGF	617.7		1005.3
ENG SFC, LBM/HP-HR	.333		.356

NOTE - ENGINE OPERATING DATA ARE BASED ON USE OF DFM FUEL.

PRINTED REPORT NO. 7 - INTAKE DUCTS

INLET TYPE IND-PLENUM
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-90 DBA

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	D DIESEL	F DIESEL	
INLET DUCT XSECT AREA,FT2	27.8	.0	.0
INLET DUCT XSECT LTH, FT	5.95	.0	.0
INLET DUCT XSECT WID, FT	5.95	.0	.0

MMR1

	----MAIN ENG----- WT,LTON	VCG,FT	-----SEC ENG----- WT,LTON	VCG,FT
INLET	0.2	88.00		
INLET DUCTING	1.7	56.79		
INLET SILENCER	0.4	30.26		
GT COOLING SUPPLY	0.0	0.00		
GT BLEED AIR SUPPLY	0.0	0.00		

MMR2

	----MAIN ENG----- WT,LTON	VCG,FT	-----SEC ENG----- WT,LTON	VCG,FT
INLET	0.2	88.00		
INLET DUCTING	1.7	57.13		
INLET SILENCER	0.4	30.26		
GT COOLING SUPPLY	0.0	0.00		
GT BLEED AIR SUPPLY	0.0	0.00		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

ENGINE CATEGORY	-----AREA,FT2---- HULL	DKHS	---VOLUME,FT3---- HULL	DKHS
MAIN ENGINES	613.2	459.9	5519.	4599.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	0.0	0.0	0.	0.
TOTALS	613.2	459.9	5519.	4599.

PRINTED REPORT NO. 8 - EXHAUST DUCTS

EXHAUST IR SUPPRESS IND-PRESENT
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-90 DBA
EXHAUST STACK TEMP, DEGF 350.0
EDUCTOR DESIGN FAC 1.000

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	D DIESEL		F DIESEL
ENG EXH TEMP, DEG	750.		946.
ENG MASS FL, LBM/SEC	37.8		7.5
EXH DUCT GAS TEMP, DEG	750.		946.
EXH DUCT GAS DEN, LBM/FT3	0.0323		.0278
EXH DUCT MASS FL, LBM/SEC	37.8		7.5
EXH DUCT AREA, FT2	10.9		2.5

MMR1

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	6.4	57.10		
EXH SILENCER	1.1	32.26		
EXH STACK	.6	98.30		
EXH SPRAY RING	.9	66.76		
EXH EDUCTOR	1.0	96.04		

MMR2

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	6.5	56.73		
EXH SILENCER	1.1	32.26		
EXH STACK	.6	98.30		
EXH SPRAY RING	.9	66.76		
EXH EDUCTOR	1.0	96.04		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

	-----AREA,FT2----		---VOLUME,FT3----	
ENGINE CATEGORY	HULL	DKHS	HULL	DKHS
MAIN ENGINES	965.7	724.2	8691.	7242.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	418.9	261.8	3770.	2618.
TOTALS	1384.6	986.1	12461.	9861.

PRINTED REPORT NO. 9 - PROPELLERS AND SHAFTS

SHAFT SUPPORT TYPE IND-OPEN STRUT	
SHAFT SYS SIZE IND-CALC	
PROP TYPE IND-CP	
PROP DIA, FT	15.03
HUB DIA, FT	4.73
PROP BLADE WT, LTON	6.9
PROP HUB WT, LTON	12.3
BEND STRESS CON FAC	1.700
OVRHG PROP MOM ARM RATIO	0.340
EQUIV FP PROP WT, LTON	15.3
ALLOW BEND STRESS, LBF/IN2	6000.
FATIGUE LIMIT, LBF/IN2	47500.
YIELD POINT, LBF/IN2	75000.
TORQUE MARGIN FAC	1.200
OFF-CENTER THRUST FAC	1.000
NO STRUTS PER SHAFT	2

PORT SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	1.83	1.83	1.83
LENGTH, FT	12.77	118.37	121.43
DIAMETER, FT	2.06	1.36	1.19
BORE RATIO	.550	.667	.667
WEIGHT, LTON	8.7	28.1	18.4
LCG, FT	597.73	532.19	412.36
TCG, FT	-10.86	-10.86	-10.86
VCG, FT	6.70	8.80	12.63
FACTOR OF SAFETY		2.00	1.75

STBD SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	1.39	1.39	1.39
LENGTH, FT	12.77	126.87	247.87
DIAMETER, FT	2.06	1.36	1.19
BORE RATIO	.550	.667	.667
WEIGHT, LTON	8.7	30.2	37.5
LCG, FT	597.73	527.93	340.62
TCG, FT	10.86	10.86	10.86
VCG, FT	6.63	8.33	12.88
FACTOR OF SAFETY		2.00	1.75

PRINTED REPORT NO. 14 - PROPULSION PLANT WEIGHT

SWBS	COMPONENT	WT,LTON	LCG,FT	VCG,FT
200	PROPULSION PLANT	1081.6	339.72	16.04
210	ENERGY GENERATING SYSTEM (NUCLEAR)	0.0	0.00	0.00
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)	0.0	0.00	0.00
230	PROPULSION UNITS	470.6	277.65	13.59
233	PROPULSION INTERNAL COMBUSTION ENGINES	470.6	277.65	13.59

234	PROPULSION GAS TURBINES	0.0	0.00	0.00
235	ELECTRIC PROPULSION	0.0	0.00	0.00
240	TRANSMISSION AND PROPULSOR SYSTEMS	281.3	432.18	11.09
241	PROPULSION REDUCTION GEARS	64.9	277.65	15.42
242	PROPULSION CLUTCHES AND COUPLINGS	0.0	0.00	0.00
243	PROPULSION SHAFTING	131.6	468.52	10.11
244	PROPULSION SHAFT BEARINGS	35.6	421.91	11.41
245	PROPULSORS	49.1	546.46	7.77
250	PRPLN SUPPORT SYS (EXCEPT FUEL+LUBE OIL)	205.6	362.42	31.63
251	COMBUSTION AIR SYSTEM	9.5	277.72	55.38
252	PROPULSION CONTROL SYSTEM	12.6	277.65	40.30
256	CIRCULATING AND COOLING SEA WATER SYSTEM	146.0	396.90	22.32
259	UPTAKES (INNER CASING)	37.5	278.04	58.92
260	PRPLN SUPPORT SYS (FUEL+LUBE OIL)	56.7	271.47	12.22
261	FUEL SERVICE SYSTEM	9.4	246.15	7.59
262	MAIN PROPULSION LUBE OIL SYSTEM	33.8	277.65	12.00
264	LUBE OIL FILL, TRANSFER, AND PURIF	13.5	273.65	16.00
290	SPECIAL PURPOSE SYSTEMS	67.5	375.38	9.46
298	OPERATING FLUIDS	62.9	378.00	8.00
299	REPAIR PARTS AND SPECIAL TOOLS	4.7	340.20	29.14

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 18 - MACHINERY SPACE REQUIREMENTS
MACHINERY ROOM VOLUME REQUIREMENTS

VOLUME CATEGORY	VOLUME, FT3
SWBS GROUP 200	179967.
PROPULSION POWER GENERATION	58600.
PROPULSION ENGINES	48105.
PROPULSION REDUCTION GEARS AND GENERATORS	10495.
DRIVELINE MACHINERY	0.
REDUCTION AND BEVEL GEARS WITH Z-DRIVE	0.
ELECTRIC PROPULSION MOTORS AND GEARS	0.
REMOTELY-LOCATED THRUST BEARINGS	0.
PROPELLER SHAFT	21571.
ELECTRIC PROPULSION MISCELLANEOUS EQUIPMENT	0.
CONTROLS	0.
BRAKING RESISTORS	0.
MOTOR AND GENERATOR EXCITERS	0.
SWITCHGEAR	0.
POWER CONVERTERS	0.
DEIONIZED COOLING WATER SYSTEMS	0.
RECTIFIERS	0.
HELIUM REFRIGERATION SYSTEMS	0.
PROPULSION AUXILIARIES	99796.
PROPULSION LOCAL CONTROL CONSOLES	4690.
CP PROP HYDRAULIC OIL POWER MODULES	4036.
FUEL OIL PUMPS	43253.
LUBE OIL PUMPS	6744.
LUBE OIL PURIFIERS	19888.
ENGINE LUBE OIL CONDITIONERS	1561.
SEAWATER COOLING PUMPS	19623.
SWBS GROUP 300	73892.
ELECTRIC PLANT POWER GENERATION	16535.
ELECTRIC PLANT ENGINES	8592.
ELECTRIC PLANT GENERATORS AND GEARS	7943.
SHIP SERVICE SWITCHBOARDS	57357.
CYCLOCONVERTERS	0.
SWBS GROUP 500	90416.
AUXILIARY MACHINERY	90416.
AIR CONDITIONING PLANTS	10757.
AUXILIARY BOILERS	17775.
FIRE PUMPS	6475.
DISTILLING PLANTS	30154.
AIR COMPRESSORS	20312.
ROLL FIN PAIRS	0.
SEWAGE PLANTS	4942.

ARRANGEABLE AREA REQUIREMENTS

SSCS	GROUP NAME	HULL/DKHS (FT2)	DKHS ONLY (FT2)
4.31	AUXILIARY MACHINERY DELTA	-966.8	0.0
4.3311	SHIP SERVICE POWER GENERATION	0.0	0.0
4.132	INTERNAL COMB ENG COMB AIR	613.2	459.9
4.133	INTERNAL COMB ENG EXHAUST	1384.6	986.1
4.142	GAS TURBINE ENG COMB AIR	0.0	0.0
4.143	GAS TURBINE ENG EXHAUST	0.0	0.0

NOTE: * DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

ASSET/MONOLA VERSION 1.0 - SPACE MODULE - 9/29/94 08.58.47.

PRINTED REPORT NO. 6 - REQUIRED TANKAGE

POLLUTION CNTRL IND-PRESENT

ENDURANCE FUEL, FT3	109139.
AVIATION FUEL, FT3	0.
FRESH WATER, FT3	2752.
SEWAGE, FT3	1013.
WASTE OIL WATER, FT3	2183.
CLEAN BALLAST, FT3	30123.
TANKAGE MARGIN, FT3	0.

TANKAGE VOL REQ, FT3	145210.

ASSET/MONOLA VERSION 1.0 - DESIGN SUMMARY - 9/29/94 08.58.51.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

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 PRINCIPAL CHARACTERISTICS - FT         WEIGHT SUMMARY - LTON
LBP                    630.0   GROUP 1 - HULL STRUCTURE  8229.3
LOA                    653.8   GROUP 2 - PROP PLANT      1322.9
BEAM, DWL               90.0   GROUP 3 - ELECT PLANT      619.8
BEAM, WEATHER DECK     103.7   GROUP 4 - COMM + SURVEIL   169.8
DEPTH @ STA 10          62.0   GROUP 5 - AUX SYSTEMS     1853.4
DRAFT TO KEEL DWL       23.0   GROUP 6 - OUTFIT + FURN   1188.3
DRAFT TO KEEL LWL       23.0   GROUP 7 - ARMAMENT          50.9
FREEBOARD @ STA 3       43.0   --------------------------------
GMT                      9.1   SUM GROUPS 1-7           13434.4
CP                     0.570   DESIGN MARGIN             1680.9
CX                     0.920   --------------------------------
                               LIGHTSHIP WEIGHT         15115.4
SPEED(KT): MAX= 25.4 SUST= 23.6   LOADS                  4572.9
ENDURANCE: 6000.0 NM AT 16.0 KTS  -----------------------------
                               FULL LOAD DISPLACEMENT   19688.3
TRANSMISSION TYPE:      MECH   FULL LOAD KG: FT            39.6
MAIN ENG: 4 D DIESEL @ 11700.0 HP
                               MILITARY PAYLOAD WT - LTON   0.0
SHAFT POWER/SHAFT: 22819.4 HP  USABLE FUEL WT - LTON     1130.7
PROPELLERS: 2 - CP - 15.0 FT DIA
                               AREA SUMMARY - FT2
SEP GEN: 4 F DIESEL @ 2000.0 KW   HULL AREA           - 160418.8
                               SUPERSTRUCTURE AREA  - 103963.0
                               --------------------------------
24 HR LOAD            4637.6   TOTAL AREA                264381.8
MAX MARG ELECT LOAD  14019.9
                               VOLUME SUMMARY - FT3
        OFF CPO ENL  TOTAL     HULL VOLUME            - 2702387.8
MANNING  49  33 386    468     SUPERSTRUCTURE VOLUME - 1036390.8
ACCOM    52  35 418    505     --------------------------------
                               TOTAL VOLUME          3738778.5
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ALL OF SHIP 'CMD04' HAS BEEN USED.

ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 9/30/94 14.43.16.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	27.31
ELECT PRPLN TYPE IND	ACC-AC	SUSTN SPEED IND	CALC
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.46
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	16.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	13823.	ENDURANCE, NM	6000.
AVG 24 HR ELECT LOAD, KW	4653.	USABLE FUEL WT, LTON	2446.0
SWBS 200 GROUP WT, LTON	914.9	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	962.8		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	4	4	2
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	2000. KW	2	1	0
VSCF SS CYCLO	1000. KW	4	4	2

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	GE-LM2500-30		MTU-16V538
ENG TYPE IND	GT		F DIESEL
ENG SIZE IND	GIVEN		GIVEN
NO INSTALLED	4	0	2
ENG PWR AVAIL, HP	26250.	.	3126.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.393		.345
ENG LOAD FRAC	1.000		.893

PRINTED REPORT NO. 3 - ENGINES

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG TYPE IND	GT		F DIESEL
ENG MODEL IND	GE-LM2500-30		MTU-16V538
ENG SIZE IND	GIVEN		GIVEN
NO INSTALLED	4	0	2
ENG BARE WT, LTON	3.1		6.6
ENG LENGTH, FT	15.65		10.37
ENG WIDTH, FT	5.20		5.38
ENG HEIGHT, FT	5.20		7.56
ENG PWR AVAIL, HP	26250.	.0	3126.3
ENG RPM	3600.0		1800.0
ENG MASS FL, LBM/SEC	135.5		8.3
ENG EXH TEMP, DEGF	1039.0		943.2
ENG SFC EQN IND	EXPNT		DIESEL
ENG SFC, LBM/HP-HR	0.393		.345

MAX SPEED CONDITION

	MAIN ENG	SEC ENG	SS ENG
NO OPERATING	4	0	1
ENG PWR, HP	26250.		4660.2
ENG RPM	3600.0		1800.0
ENG MASS FL, LBM/SEC	135.5		9.6
ENG EXH TEMP, DEGF	1039.0		1119.1
ENG SFC, LBM/HP-HR	.393		.352

SUSTN SPEED CONDITION

	MAIN ENG	SEC ENG	SS ENG
NO OPERATING	4	0	1
ENG PWR, HP	21469.		4660.2
ENG RPM	3343.6		1800.0
ENG MASS FL, LBM/SEC	125.4		9.6
ENG EXH TEMP, DEGF	991.1		1119.1
ENG SFC, LBM/HP-HR	.411		.352

ENDUR SPEED CONDITION

	MAIN ENG	SEC ENG	SS ENG
ENG ENDUR RPM IND	CALC		
NO OPERATING	2	0	0
ENG PWR, HP	14660.		.0
ENG RPM	2964.6		1800.0
ENG MASS FL, LBM/SEC	108.3		.0
ENG EXH TEMP, DEGF	924.6		
ENG SFC, LBM/HP-HR	.456		

NOTE - ENGINE OPERATING DATA ARE BASED ON USE OF DFM FUEL.

PRINTED REPORT NO. 7 - INTAKE DUCTS

INLET TYPE IND-PLENUM
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-84 DBA

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	GT	F DIESEL	
INLET DUCT XSECT AREA,FT2	99.6	.0	.0
INLET DUCT XSECT LTH, FT	11.45	.0	.0
INLET DUCT XSECT WID, FT	8.70	.0	.0

MMR1

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
INLET	0.8	88.00		
INLET DUCTING	3.5	54.20		
INLET SILENCER	2.8	40.34		
GT COOLING SUPPLY	3.6	41.85		
GT BLEED AIR SUPPLY	3.9	33.10		

MMR2

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
INLET	0.8	88.00		
INLET DUCTING	3.5	54.20		
INLET SILENCER	2.8	40.34		
GT COOLING SUPPLY	3.6	41.85		
GT BLEED AIR SUPPLY	3.9	33.10		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

	-----AREA,FT2----		---VOLUME,FT3----	
ENGINE CATEGORY	HULL	DKHS	HULL	DKHS
MAIN ENGINES	1912.8	1434.6	17215.	14346.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	0.0	0.0	0.	0.
TOTALS	1912.8	1434.6	17215.	14346.

PRINTED REPORT NO. 8 - EXHAUST DUCTS

EXHAUST IR SUPPRESS IND-PRESENT
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-84 DBA
EXHAUST STACK TEMP, DEGF 350.0
EDUCTOR DESIGN FAC 1.000

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	GT		F DIESEL
ENG EXH TEMP, DEG	1039.		905.
ENG MASS FL, LBM/SEC	135.5		7.9
EXH DUCT GAS TEMP, DEG	927.		905.
EXH DUCT GAS DEN, LBM/FT3	0.0282		.0286
EXH DUCT MASS FL, LBM/SEC	154.5		7.9
EXH DUCT AREA, FT2	51.0		2.6

MMR1

	MAIN ENG WT,LTON	MAIN ENG VCG,FT	SEC ENG WT,LTON	SEC ENG VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	15.0	54.20		
EXH SILENCER	11.2	48.67		
EXH STACK	3.0	98.30		
EXH SPRAY RING	1.3	65.73		
EXH EDUCTOR	13.7	101.81		

MMR2

	MAIN ENG WT,LTON	MAIN ENG VCG,FT	SEC ENG WT,LTON	SEC ENG VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	15.0	54.20		
EXH SILENCER	11.2	48.67		
EXH STACK	3.0	98.30		
EXH SPRAY RING	1.3	65.73		
EXH EDUCTOR	13.7	101.81		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

ENGINE CATEGORY	AREA,FT2 HULL	AREA,FT2 DKHS	VOLUME,FT3 HULL	VOLUME,FT3 DKHS
MAIN ENGINES	2528.3	1896.3	22755.	18963.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	212.9	133.0	1916.	1330.
TOTALS	2741.2	2029.3	24671.	20293.

PRINTED REPORT NO. 9 - PROPELLERS AND SHAFTS

SHAFT SUPPORT TYPE IND-POD
SHAFT SYS SIZE IND-CALC
PROP TYPE IND-FP

PROP DIA, FT	19.29
HUB DIA, FT	12.85
PROP BLADE WT, LTON	11.6
PROP HUB WT, LTON	15.9
BEND STRESS CON FAC	1.000
OVRHG PROP MOM ARM RATIO	0.340
EQUIV FP PROP WT, LTON	27.4
ALLOW BEND STRESS, LBF/IN2	6000.
FATIGUE LIMIT, LBF/IN2	47500.
YIELD POINT, LBF/IN2	75000.
TORQUE MARGIN FAC	1.200
OFF-CENTER THRUST FAC	1.000
NO STRUTS PER SHAFT	0

PORT SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	-4.18		
LENGTH, FT	4.82		
DIAMETER, FT	2.19		
BORE RATIO	.550		
WEIGHT, LTON	3.7		
LCG, FT	579.87		
TCG, FT	-14.15		
VCG, FT	1.54		
FACTOR OF SAFETY			

STBD SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	-4.18		
LENGTH, FT	4.82		
DIAMETER, FT	2.19		
BORE RATIO	.550		
WEIGHT, LTON	3.7		
LCG, FT	579.87		
TCG, FT	14.15		
VCG, FT	1.54		
FACTOR OF SAFETY			

PRINTED REPORT NO. 14 - PROPULSION PLANT WEIGHT

SWBS	COMPONENT	WT,LTON	LCG,FT	VCG,FT
200	PROPULSION PLANT	914.9	392.11	22.12
210	ENERGY GENERATING SYSTEM (NUCLEAR)	0.0	0.00	0.00
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)	0.0	0.00	0.00
230	PROPULSION UNITS	504.8	425.18	8.21
233	PROPULSION INTERNAL COMBUSTION ENGINES	0.0	0.00	0.00
234	PROPULSION GAS TURBINES	100.1	271.86	12.40
235	ELECTRIC PROPULSION	404.7	463.09	7.17
240	TRANSMISSION AND PROPULSOR SYSTEMS	92.2	578.67	1.45
241	PROPULSION REDUCTION GEARS	0.0	0.00	0.00
242	PROPULSION CLUTCHES AND COUPLINGS	0.0	0.00	0.00
243	PROPULSION SHAFTING	7.4	579.87	1.54
244	PROPULSION SHAFT BEARINGS	29.9	584.11	1.85
245	PROPULSORS	54.9	575.54	1.23
250	PRPLN SUPPORT SYS (EXCEPT FUEL+LUBE OIL)	253.7	278.79	59.60
251	COMBUSTION AIR SYSTEM	58.6	264.30	44.86
252	PROPULSION CONTROL SYSTEM	26.5	271.86	40.30
256	CIRCULATING AND COOLING SEA WATER SYSTEM	4.0	396.90	22.32
259	UPTAKES (INNER CASING)	164.6	282.22	68.85
260	PRPLN SUPPORT SYS (FUEL+LUBE OIL)	33.2	262.11	11.23
261	FUEL SERVICE SYSTEM	9.4	240.36	6.40
262	MAIN PROPULSION LUBE OIL SYSTEM	17.0	271.86	12.00
264	LUBE OIL FILL, TRANSFER, AND PURIF	6.8	267.86	16.00
290	SPECIAL PURPOSE SYSTEMS	31.0	365.21	15.16
298	OPERATING FLUIDS	20.5	378.00	8.00
299	REPAIR PARTS AND SPECIAL TOOLS	10.5	340.20	29.14

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 18 - MACHINERY SPACE REQUIREMENTS

MACHINERY ROOM VOLUME REQUIREMENTS

VOLUME CATEGORY	VOLUME, FT3
SWBS GROUP 200	152946.
PROPULSION POWER GENERATION	54143.
PROPULSION ENGINES	33861.
PROPULSION REDUCTION GEARS AND GENERATORS	20283.
DRIVELINE MACHINERY	0.
REDUCTION AND BEVEL GEARS WITH Z-DRIVE	0.
ELECTRIC PROPULSION MOTORS AND GEARS	0.
REMOTELY-LOCATED THRUST BEARINGS	0.
PROPELLER SHAFT	0.
ELECTRIC PROPULSION MISCELLANEOUS EQUIPMENT	21832.
CONTROLS	2705.
BRAKING RESISTORS	2683.
MOTOR AND GENERATOR EXCITERS	4826.
SWITCHGEAR	2399.
POWER CONVERTERS	4321.
DEIONIZED COOLING WATER SYSTEMS	4898.
RECTIFIERS	0.
HELIUM REFRIGERATION SYSTEMS	0.
PROPULSION AUXILIARIES	76970.
PROPULSION LOCAL CONTROL CONSOLES	4725.
CP PROP HYDRAULIC OIL POWER MODULES	0.
FUEL OIL PUMPS	43571.
LUBE OIL PUMPS	4571.
LUBE OIL PURIFIERS	20034.
ENGINE LUBE OIL CONDITIONERS	1573.
SEAWATER COOLING PUMPS	2496.
SWBS GROUP 300	82303.
ELECTRIC PLANT POWER GENERATION	8630.
ELECTRIC PLANT ENGINES	4659.
ELECTRIC PLANT GENERATORS AND GEARS	3971.
SHIP SERVICE SWITCHBOARDS	70663.
CYCLOCONVERTERS	3010.
SWBS GROUP 500	91081.
AUXILIARY MACHINERY	91081.
AIR CONDITIONING PLANTS	10837.
AUXILIARY BOILERS	17906.
FIRE PUMPS	6522.
DISTILLING PLANTS	30376.
AIR COMPRESSORS	20461.
ROLL FIN PAIRS	0.
SEWAGE PLANTS	4979.

ARRANGEABLE AREA REQUIREMENTS

		----------FT2----------	
SSCS	GROUP NAME	HULL/DKHS	DKHS ONLY
4.31	AUXILIARY MACHINERY DELTA	-6757.7	0.0
4.3311	SHIP SERVICE POWER GENERATION	0.0	0.0
4.132	INTERNAL COMB ENG COMB AIR	0.0	0.0
4.133	INTERNAL COMB ENG EXHAUST	212.9	133.0
4.142	GAS TURBINE ENG COMB AIR	1912.8	1434.6
4.143	GAS TURBINE ENG EXHAUST	2528.3	1896.3

NOTE: * DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

ASSET/MONOLA VERSION 1.0 - SPACE MODULE - 9/30/94 14.43.25.

PRINTED REPORT NO. 6 - REQUIRED TANKAGE

POLLUTION CNTRL IND-PRESENT

ENDURANCE FUEL, FT3	109139.
AVIATION FUEL, FT3	0.
FRESH WATER, FT3	2752.
SEWAGE, FT3	1013.
WASTE OIL WATER, FT3	2183.
CLEAN BALLAST, FT3	30123.
TANKAGE MARGIN, FT3	0.

TANKAGE VOL REQ, FT3	145210.

ASSET/MONOLA VERSION 1.0 - DESIGN SUMMARY - 9/30/94 14.43.32.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PRINCIPAL CHARACTERISTICS - FT WEIGHT SUMMARY - LTON
LBP 630.0 GROUP 1 - HULL STRUCTURE 8417.7
LOA 653.8 GROUP 2 - PROP PLANT 2261.8
BEAM, DWL 90.0 GROUP 3 - ELECT PLANT 330.9
BEAM, WEATHER DECK 103.4 GROUP 4 - COMM + SURVEIL 169.8
DEPTH @ STA 10 62.0 GROUP 5 - AUX SYSTEMS 1897.6
DRAFT TO KEEL DWL 23.9 GROUP 6 - OUTFIT + FURN 1186.0
DRAFT TO KEEL LWL 23.9 GROUP 7 - ARMAMENT 50.9
FREEBOARD @ STA 3 42.1 --------------------------------
GMT 9.0 SUM GROUPS 1-7 14314.7
CP 0.570 DESIGN MARGIN 1791.1
CX 0.910 --------------------------------
LIGHTSHIP WEIGHT 16105.8
SPEED(KT): MAX= 27.3 SUST= 25.5 LOADS 4572.9
ENDURANCE: 6000.0 NM AT 16.0 KTS --------------------------------
FULL LOAD DISPLACEMENT 20678.7
TRANSMISSION TYPE: ELECT FULL LOAD KG: FT 38.4
MAIN ENG: 4 GT @ 26250.0 HP
MILITARY PAYLOAD WT - LTON 0.0
SHAFT POWER/SHAFT: 44559.4 HP USABLE FUEL WT - LTON 2446.0
PROPELLERS: 2 - FP - 19.3 FT DIA
AREA SUMMARY - FT2
SEP GEN: 2 F DIESEL @ 2000.0 KW HULL AREA - 154085.6
PD GEN: 4 VSCF @ 1000.0 KW SUPERSTRUCTURE AREA - 103967.1
----
24 HR LOAD 4652.7 TOTAL AREA 258052.6
MAX MARG ELECT LOAD 13823.2
VOLUME SUMMARY - FT3
OFF CPO ENL TOTAL HULL VOLUME - 2669320.0
MANNING 49 33 386 468 SUPERSTRUCTURE VOLUME - 1036431.0
ACCOM 52 35 418 505 --------------------------------
TOTAL VOLUME 3705751.0

APPENDIX G

DETAILED LISTING OF ASSET MODEL FOR MEDIUM SIZED CMD

ADVANCED SURFACE SHIP EVALUATION TOOL (ASSET)
MONOHULL L AND A TYPE SHIPS (MONOLA)
VERSION 1.0
DATED OCTOBER 29,1993

SYNTHESIS

```
HULL GEOM MODULE                0.750 CPU SECONDS.
** WARNING - HULL SUBDIV MODULE ** (W-DECKLOCRESET-ADECKS)
HULL DECK LOC ARRAY ELEMENT NUMBER(S) 1     HAVE BEEN RESET TO MATCH THE
HULL OFFSETS.

** WARNING - HULL SUBDIV MODULE ** (W-MAINDEKHTRESET-ADECKS)
THE MAIN DECK HT HAS BEEN RE-SET TO  62.00
 TO MATCH ELEMENT #  1 IN THE DECK LOC ARRAY

HULL SUBDIV MODULE              3.750 CPU SECONDS.
DECKHOUSE MODULE                0.250 CPU SECONDS.
HULL STRUCT MODULE              2.000 CPU SECONDS.
APPENDAGE MODULE                0.125 CPU SECONDS.
RESISTANCE MODULE               0.375 CPU SECONDS.
PROPELLER MODULE                0.500 CPU SECONDS.

** WARNING - MACHINERY MODULE ** (W-TOTALSSGENLT3-MHYMSG)
TOTAL NUMBER OF SHIP SERVICE GENERATORS (INCLUDING VSCF, IF ANY),
IS LESS THAN THREE.
** WARNING - MACHINERY MODULE ** (W-ZEROSBYSSGEN-MHYMSG)
NO STANDBY SHIP-SERVICE GENERATORS EXIST AT BATTLE ELECTRICAL
LOADING CONDITION.
** WARNING - MACHINERY MODULE ** (W-OPSSGENENDURLT2-MHYMSG)
NUMBER OF SHIP SERVICE GENERATORS OPERATING AT ENDURANCE CONDITION IS
LESS THAN TWO.
** WARNING - MACHINERY MODULE ** (W-SEPSSGEN2SMALL-MHYMSG)
GENERATING CAPACITY OF SEPARATE SHIP-SERVICE GENERATORS  IS INADEQUATE
TO MEET REQUIRED LOAD AT ONE OR MORE CONDITIONS. INCREASE EITHER
NUMBER OF INSTALLED GENERATORS (SS ARR NO ARRAY), NUMBER OF OPERATING
GENERATORS (SEP SS GEN  OP ARRAY), OR INCREASE GENERATOR RATING (SEP SS
GEN KW).
    SEP SS GEN KW (AVAIL)       2000.0
    SEP SS GEN  KW REQ          14305.1
MACHINERY MODULE                4.500 CPU SECONDS.
WEIGHT MODULE                   4.625 CPU SECONDS.
SPACE MODULE                    1.125 CPU SECONDS.
DESIGN SUMMARY                  0.000 CPU SECONDS.

CONVERGENCE ACHIEVED IN  1 ITERATIONS FOR THE FOLLOWING SYNTHESIS LOOP:
   BEGINNING MODULE = HULL GEOM MODULE
   ENDING MODULE    = DESIGN SUMMARY
SYNTHESIS PROCESS SUCCESSFULLY COMPLETED.
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PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE		MIN BEAM, FT	88.00
HULL DIM IND-T		MAX BEAM, FT	110.00
MARGIN LINE IND-CALC		HULL FLARE ANGLE, DEG	7.00
HULL STA IND-OPTIMUM		FORWARD BULWARK, FT	4.00
HULL BC IND-GIVEN			

HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	630.00	PRISMATIC COEF	0.570
LOA, FT	653.80	MAX SECTION COEF	0.910
BEAM, FT	90.00	WATERPLANE COEF	0.783
BEAM @ WEATHER DECK, FT	99.52	LCB/LCP	0.512
DRAFT, FT	23.24	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	62.00	BOT RAKE, FT	0.00
DEPTH STA 3, FT	62.00	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	62.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	62.00	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	42.76	BARE HULL DISPL, LTON	19526.91

BARE HULL DATA ON LWL		STABILITY DATA ON LWL	
LGTH ON WL, FT	630.00	KB, FT	13.69
BEAM, FT	89.95	BMT, FT	35.24
DRAFT, FT	23.22	KG, FT	39.97
FREEBOARD @ STA 3, FT	42.78	FREE SURF COR, FT	0.00
PRISMATIC COEF	0.569	SERV LIFE KG ALW, FT	0.00
MAX SECTION COEF	0.914		
WATERPLANE COEF	0.784	GMT, FT	8.96
WATERPLANE AREA, FT2	44403.98	GML, FT	1505.82
WETTED SURFACE, FT2	57029.98		
BARE HULL DISPL, LTON	19538.06		
APPENDAGE DISPL, LTON	130.23		
FULL LOAD WT, LTON	19668.28		

PRINTED REPORT NO. 2 - HULL OFFSETS

STATION NO. 1, AT X = -23.797 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	0.000	61.697
2	0.473	61.773
3	1.006	61.849
4	1.546	61.924
5	1.815	62.000

STATION NO. 2, AT X = -11.898 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	0.000	45.112
2	1.667	49.334
3	4.104	53.556
4	6.934	57.778
5	9.556	62.000

STATION NO. 3, AT X = 0.000 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	0.225	23.236
2	2.258	32.927
3	5.041	42.618
4	8.727	52.309
5	13.469	62.000

STATION NO. 4, AT X = 4.905 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	0.000	7.278
2	0.007	7.294
3	0.052	7.405
4	0.157	7.709
5	0.319	8.299
6	0.499	9.273
7	0.629	10.725
8	0.656	12.752
9	0.606	15.449
10	0.649	18.911
11	1.142	23.236
12	3.333	32.927
13	6.353	42.618
14	10.281	52.309
15	15.196	62.000

STATION NO. 5, AT X = 9.810 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	0.000	0.000
2	0.036	0.023
3	0.162	0.186
4	0.316	0.627
5	0.456	1.487
6	0.556	2.905
7	0.610	5.019
8	0.647	7.970
9	0.758	11.897
10	1.129	16.939
11	2.067	23.236
12	4.406	32.927
13	7.647	42.618
14	11.799	52.309
15	16.873	62.000

STATION NO. 6, AT X = 42.461 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	0.768	0.000
2	0.826	0.023
3	1.038	0.186
4	1.325	0.627
5	1.674	1.487
6	2.133	2.905
7	2.797	5.019
8	3.765	7.970
9	5.089	11.897
10	6.713	16.939
11	8.447	23.236
12	11.529	32.927
13	15.850	42.618
14	21.061	52.309
15	26.810	62.000

STATION NO. 7, AT X = 75.112 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	0.000
2	1.002	0.001
3	1.128	0.032
4	1.634	0.255
5	2.495	0.861
6	3.750	2.040
7	5.445	3.984
8	7.583	6.885
9	10.083	10.933
10	12.728	16.320
11	15.117	23.236
12	18.560	32.927
13	23.346	42.618
14	28.928	52.309
15	34.760	62.000

STATION NO. 8, AT X = 107.764 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	0.000
2	2.371	0.036
3	2.574	0.068
4	3.382	0.291
5	4.749	0.896
6	6.705	2.073
7	9.259	4.014
8	12.334	6.910
9	15.725	10.952
10	19.067	16.330
11	21.772	23.236
12	25.271	32.927
13	30.038	42.618
14	35.461	52.309
15	40.926	62.000

STATION NO. 9, AT X = 140.415 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	0.000
2	5.826	0.128
3	6.123	0.160
4	7.224	0.382
5	8.906	0.984
6	11.141	2.157
7	13.972	4.090

8	17.398	6.975
9	21.257	11.001
10	25.089	16.358
11	28.023	23.236
12	31.360	32.927
13	35.779	42.618
14	40.693	52.309
15	45.513	62.000

STATION NO. 10, AT X = 173.066 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	0.000
2	10.665	0.256
3	11.039	0.288
4	12.362	0.509
5	14.235	1.108
6	16.555	2.274
7	19.384	4.197
8	22.791	7.065
9	26.679	11.069
10	30.583	16.396
11	33.505	23.236
12	36.552	32.927
13	40.446	42.618
14	44.673	52.309
15	48.724	62.000

STATION NO. 11, AT X = 205.718 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	0.000
2	16.187	0.403
3	16.586	0.434
4	17.993	0.654
5	19.959	1.249
6	22.338	2.408
7	25.130	4.318
8	28.352	7.168
9	31.891	11.146
10	35.358	16.439
11	37.957	23.236
12	40.664	32.927
13	43.978	42.618
14	47.483	52.309
15	50.765	62.000

STATION NO. 12, AT X = 238.369 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	0.000
2	21.689	0.549
3	22.088	0.580
4	23.514	0.798
5	25.540	1.389
6	27.981	2.541
7	30.723	4.439
8	33.636	7.271
9	36.540	11.223
10	39.192	16.483
11	41.253	23.236
12	43.630	32.927
13	46.395	42.618
14	49.236	52.309
15	51.839	62.000

STATION NO. 13, AT X = 271.020 FT

POINT	HALF BEAM,FT	WATERLINE,FT
1	1.000	0.000
2	26.470	0.676
3	26.868	0.707
4	28.306	0.923
5	30.373	1.511
6	32.839	2.656
7	35.470	4.544
8	37.988	7.360
9	40.159	11.291
10	41.910	16.521
11	43.413	23.236
12	45.509	32.927
13	47.793	42.618
14	50.071	52.309
15	52.150	62.000

STATION NO. 14, AT X = 303.672 FT

POINT	HALF BEAM,FT	WATERLINE,FT
1	1.000	0.000
2	29.829	0.765
3	30.225	0.796
4	31.656	1.012
5	33.698	1.597
6	36.087	2.738
7	38.527	4.618
8	40.673	7.423
9	42.287	11.338
10	43.426	16.547
11	44.583	23.236
12	46.504	32.927
13	48.453	42.618
14	50.358	52.309
15	52.150	62.000

STATION NO. 15, AT X = 336.323 FT

POINT	HALF BEAM,FT	WATERLINE,FT
1	1.000	0.000
2	30.015	0.770
3	30.488	0.791
4	31.800	0.938
5	33.523	1.338
6	35.503	2.116
7	37.609	3.398
8	39.680	5.312
9	41.495	7.982
10	42.727	11.536
11	45.002	23.236
12	46.858	32.927
13	48.663	42.618
14	50.425	52.309
15	52.150	62.000

STATION NO. 16, AT X = 368.974 FT

POINT	HALF BEAM,FT	WATERLINE,FT
1	1.000	0.000
2	24.186	0.615
3	24.592	0.646
4	26.176	0.863
5	28.713	1.453
6	32.010	2.601
7	35.671	4.494

8	39.103	7.318
9	41.785	11.259
10	43.581	16.503
11	44.945	23.236
12	46.808	32.927
13	48.630	42.618
14	50.408	52.309
15	52.140	62.000

STATION NO. 17, AT X = 401.626 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	0.000
2	15.492	0.385
3	15.907	0.416
4	17.582	0.635
5	20.420	1.231
6	24.355	2.391
7	29.103	4.303
8	34.117	7.155
9	38.742	11.136
10	42.399	16.434
11	44.673	23.236
12	46.575	32.927
13	48.481	42.618
14	50.344	52.309
15	52.115	62.000

STATION NO. 18, AT X = 439.688 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	1.061
2	5.773	1.187
3	6.144	1.218
4	7.732	1.429
5	10.639	2.004
6	15.007	3.123
7	20.784	4.968
8	27.589	7.720
9	34.665	11.561
10	40.825	16.673
11	44.322	23.236
12	46.252	32.927
13	48.263	42.618
14	50.238	52.309
15	52.062	62.000

STATION NO. 19, AT X = 477.750 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	4.169
2	1.024	4.169
3	1.282	4.195
4	2.500	4.378
5	4.991	4.875
6	9.110	5.843
7	15.083	7.439
8	22.793	9.819
9	31.505	13.140
10	39.551	17.561
11	43.979	23.236
12	45.973	32.927
13	48.071	42.618
14	50.123	52.309
15	51.980	62.000

STATION NO. 20, AT X = 515.813 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	8.572
2	1.121	8.587
3	1.734	8.689
4	3.061	8.968
5	5.425	9.511
6	9.230	10.405
7	14.837	11.740
8	22.285	13.602
9	30.921	16.080
10	39.003	19.262
11	43.363	23.236
12	45.641	32.927
13	47.888	42.618
14	49.998	52.309
15	51.863	62.000

STATION NO. 21, AT X = 553.875 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	12.988
2	1.077	12.999
3	1.516	13.070
4	2.585	13.265
5	4.639	13.644
6	8.122	14.269
7	13.446	15.202
8	20.706	16.503
9	29.275	18.235
10	37.389	20.459
11	41.794	23.236
12	44.847	32.927
13	47.519	42.618
14	49.806	52.309
15	51.708	62.000

STATION NO. 22, AT X = 591.938 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	16.414
2	1.056	16.420
3	1.451	16.468
4	2.537	16.598
5	4.668	16.850
6	8.179	17.266
7	13.289	17.887
8	19.917	18.754
9	27.428	19.907
10	34.367	21.387
11	38.201	23.236
12	42.938	32.927
13	46.648	42.618
14	49.462	52.309
15	51.510	62.000

STATION NO. 23, AT X = 630.000 FT

POINT	HALF BEAM, FT	WATERLINE, FT
1	1.000	19.157
2	1.048	19.161
3	1.459	19.189
4	2.665	19.267
5	4.978	19.418
6	8.514	19.667
7	13.139	20.038

8	18.466	20.556
9	23.874	21.245
10	28.505	22.131
11	31.191	23.236
12	39.458	32.927
13	45.218	42.618
14	48.983	52.309
15	51.264	62.000

PRINTED REPORT NO. 3 - HULL BOUNDARY CONDITIONS

HULL OFFSETS IND-GENERATE
HULL BC IND-GIVEN HULL STA IND-OPTIMUM

LBP, FT	630.00	LCB/LBP	0.512
BEAM, FT	90.00	LCF/LBP	0.575
DRAFT, FT	23.24	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	62.00	BOT RAKE, FT	0.00
DEPTH STA 3, FT	62.00	FWD RAISED DECK LIMIT	
DEPTH STA 10, FT	62.00	AFT RAISED DECK LIMIT	
DEPTH STA 20, FT	62.00	RAISED DECK HT, FT	0.00
PRISMATIC COEF	0.570	WATERPLANE COEF	0.783
MAX SECTION COEF	0.910		
NO POINTS BELOW DWL	11.	FWD KEEL/BL LIMIT	0.016
NO POINTS ABOVE DWL	4.	AFT KEEL/BL LIMIT	0.638
POINT DIST FAC ABOVE DWL	3.000	BOW ANGLE, DEG	66.00
POINT DIST FAC BELOW DWL	1.000	BOW SHAPE FAC	0.000
BOW OVERHANG	0.038	STA 20 SECTION COEF	0.677
STERN OVERHANG	0.031	HULL FLARE ANGLE, DEG	

SECTIONAL AREA AND DWL CURVES

	AREA	DWL
STA 0 ORDINATE	0.000	0.005
STA 0 SLOPE	-0.653	-1.303
STA 20 ORDINATE	0.090	0.693
STA 20 SLOPE	0.750	1.697
PARALLEL MID LGTH	0.000	0.000
STA MAX ORDINATE	10.400	11.000
STA MAX AREA SLOPE	0.000	0.000
TENSOR NO 1	0.000	0.000
TENSOR NO 2	0.000	0.000
TENSOR NO 3	0.000	0.000
TENSOR NO 4	0.000	0.000
TENSOR/POLY SWITCH	-1.000	-1.000

DECK AT EDGE CURVE		FLAT OF BOTTOM CURVE	
STATION 0 OFFSET	0.299	STA OF TRANS START	2.350
STA 0 SLOPE	-2.500	SLOPE-STA OF TRANS START	0.000
STA 10 OFFSET	1.158	STA OF START OF MID	10.000
STA 10 SLOPE	0.000	STA OF END OF MID	11.000
STATION 20 OFFSET	1.139	STA OF TRANS END	15.250
STA 20 SLOPE	0.050	SLOPE-STA OF TRANS END	0.000
PARALLEL MID LGTH	0.090	FLAT OF BOT ANGLE, DEG	1.520
STA OF PARALLEL MID	9.500	ELLIPSE RATIO	1.000

SLOPES AT SECTION CURVES

	BOT	DWL	DAE
STA 0 ORDINATE, DEG	30.000	80.000	61.233
STA 0 SLOPE	120.000	35.601	35.405
STA 10 ORDINATE, DEG	2.000	79.000	80.000
STA 10 SLOPE	0.000	-0.250	0.000
STA 20 ORDINATE, DEG	4.000	45.000	80.000
STA 20 SLOPE	20.000	165.000	0.000
PARALLEL MID LGTH	0.300	0.167	0.073
STA OF PARALLEL MID	10.000	11.253	10.506

PRINTED REPORT NO. 4 - MARGIN LINE

MARGIN LINE IND-CALC
MIN FREEBOARD MARGIN, FT 0.25

DIST FROM FP FT	HT ABOVE BL FT
-23.80	61.75
-11.90	61.75
0.00	61.75
4.90	61.75
9.81	61.75
42.46	61.75
75.11	61.75
107.76	61.75
140.42	61.75
173.07	61.75
205.72	61.75
238.37	61.75
271.02	61.75
303.67	61.75
336.32	61.75
368.97	61.75
401.63	61.75
439.69	61.75
477.75	61.75
515.81	61.75
553.88	61.75
591.94	61.75
630.00	61.75

PRINTED REPORT NO. 5 - HULL SECTIONAL AREA CURVE

STATION	LOCATION, FT	AREA, FT2
1	-23.80	0.00
2	-11.90	0.00
3	0.00	0.00
4	4.90	20.47
5	9.81	42.87
6	42.46	229.44
7	75.11	455.91
8	107.76	700.49
9	140.42	951.22
10	173.07	1198.38
11	205.72	1430.74
12	238.37	1634.02
13	271.02	1791.58
14	303.67	1886.73
15	336.32	1908.04
16	368.97	1839.92
17	401.63	1693.25
18	439.69	1437.86
19	477.75	1126.88
20	515.81	809.61
21	553.88	535.94
22	591.94	333.10
23	630.00	172.22

PRINTED REPORT NO. 1 - HULL SUBDIV SUMMARY

HULL SUBDIV IND-GIVEN		INNER BOT IND-PRESENT	
LBP, FT	630.00	HULL AVG DECK HT, FT	14.85
DEPTH STA 10, FT	62.00		
TOTAL HULL VOLUME, FT3	2689995.	NO. OF DECKS	6
		NO. OF TRANS BHDS	13
MR VOLUME, FT3	460993.	NO. OF LONG BHDS	5
TANKAGE VOL AVAIL, FT3	62711.	NO. OF MACHY RMS	6
LARGE OBJECT VOL, FT3	957463.	NO. OF LARGE OBJECT SPACES	4
TRUNK VOLUME, FT3	0.	NO. OF VERTICAL TRUNKS	0
		NO. OF CARGO RAMPS	0
HULL ARR AREA AVAIL, FT2	142336.0		

PRINTED REPORT NO. 2 - TRANSVERSE BULKHEADS

HULL SUBDIV IND-GIVEN	
NO TRANS BHDS	13

BULKHEAD NO	DISTANCE FROM FP, FT	DISTANCE FROM FP/LBP	MR FWD BHD LOC
1	31.50	0.050	
2	74.23	0.118	OMR
3	116.96	0.186	
4	159.68	0.253	MMR
5	213.72	0.339	
6	260.97	0.414	
7	308.22	0.489	MMR
8	362.25	0.575	AMR
9	409.50	0.650	AMR,AMR
10	453.60	0.720	
11	497.70	0.790	
12	541.80	0.860	
13	585.90	0.930	

PRINTED REPORT NO. 3 - LONGITUDINAL BULKHEADS

NO. OF LONG BHDS	5
LBP, FT	630.00
HALF BREADTH, FT	52.15

BKHD NO.	BULKHEAD TYPE	DIST OFF CL, FT (- IS PORT,+ IS STBD) FWD/LOW	FWD/UPP	AFT/LOW	FWD BHD ID	AFT BHD ID	UPP DECK ID	LOW DECK ID
1	PLANAR	-30.0	-30.0	-30.0	6	STERN	1	5
2	PLANAR	30.0	30.0	30.0	6	STERN	1	5
3	PLANAR	-20.0	-20.0	-20.0	5	6	1	3
4	PLANAR	20.0	20.0	20.0	5	6	1	3
5	PLANAR	0.0	.0	.0	9	10	5	IB/HB

PRINTED REPORT NO. 4 - INTERNAL DECKS AND INNER BOTTOM

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

NO. INTERNAL DECKS	5	--------- INNER BOTTOM ----------	
DEPTH STA 10, FT	62.00	CVK HT, FT	3.00
HULL AVG DECK HT, FT	14.85	HORZ OFFSET HT, FT	
RAISED DECK HT, FT	0.00	HORZ OFFSET, FT	
MAIN DECK HT, FT	62.00	FLAT FWD LOC, FT	31.50
		FLAT AFT LOC, FT	585.90
		OFFSET FWD LOC, FT	
		OFFSET AFT LOC, FT	

INT DECK NO.	DIST FROM BL AT .5 LBP,FT	DECK SHEER FRAC	DECK TYPE	AVAIL AREA FT2	AVAIL VOL FT3
2	53.00	1.0	PLATFORM	29172.1	277281.
3	44.00	1.0	PLATFORM	25601.5	290245.
4	35.00	1.0	PLATFORM	18191.4	177309.
5	26.00	1.0	PLATFORM	41125.3	1022221.
6	17.00	1.0	PLATFORM	20327.7	228442.
IB	3.00			7917.9	186897.
HOLD					46608.
			TOTALS	142336.0	2229003.

PRINTED REPORT NO. 5 - MACHINERY ROOMS AND LARGE OBJECT SPACES

MACHINERY ROOMS:

MR AFT BHD POS, FT 453.60

MR NO.	TYPE	FWD BHD ID	UPR DECK ID	OUTER BHD ID P/S	LGTH AVL FT	LGTH RQD FT	HT AVL FT	HT RQD FT	MR VOL FT3
1	OMR	2	1	H H					
2	MMR	4	2	H H	54.03	46.38	53.00	45.37	193771.
3	MMR	7	5	H H	54.03	46.38	26.00	14.37	105835.
4	AMR	8	5	H H	47.25	26.06	26.00	12.22	87907.
5	AMR	9	5	5 H	44.10	20.52	26.00	19.92	36740.
6	AMR	9	5	H 5	44.10	20.52	26.00	19.92	36740.
								TOTAL	460993.

LARGE OBJECT SPACES:

LG OBJ NO.	FWD BHD ID	AFT BHD ID	UPR DECK ID	LOWER DECK ID	OUTER BHD ID P/S	AVAIL AREA FT2	AVAIL VOLUME FT3	COMPARTMENT ID (LOWER-FWD PT.)
1	6	TR	1	5	1 2	22142.0	797135.	5-261-0
2	5	6	1	3	3 4	1890.0	34022.	3-214-0
3	2	3	1	3	SH SH	2416.1	51350.	3- 74-0
4	5	6	3	5	SH SH	3940.7	74956.	5-214-0
					TOTALS	30388.8	957463.	

PRINTED REPORT NO. 6 - CARGO RAMPS AND VERTICAL TRUNKS

CARGO RAMPS:

RAMP NO.	UPR DECK ID	LWR DECK ID	UPR DECK X LOC FT	STBD EDGE LOC FT	RAMP WIDTH FT	INCLINE ANG, DEG + AFT	AREA UNDER FT2	AREA ON FT2

VERTICAL TRUNKS:

TRUNK NO.	UPR DECK ID	LWR DECK ID	TRUNK X LOC FT	TRUNK LENGTH FT	STBD EDGE LOC FT	TRUNK WIDTH FT	TRUNK AREA FT2	TRUNK VOLUME FT3

PRINTED REPORT NO. 7 - HULL COMPARTMENT AREA/VOLUME

NUMBER OF INTERNAL DECKS - 5
NUMBER OF TRANSVERSE BULKHEADS - 13
NUMBER OF LONGITUDINAL BULKHEADS - 5
INNER BOTTOM INDICATOR - PRESENT
MAIN DECK HT, FT - 62.0

COMPARTMENT NO.	AREA FT2	AREA CENTER X	AREA CENTER Y	AREA CENTER Z	VOLUME FT3	VOLUME CENTER X	VOLUME CENTER Y	VOLUME CENTER Z
2-FPK-0	1037.0	14.0	0.0	53.0	11684.	12.2	0.0	57.8
2- 32-0	2042.2	54.5	0.0	53.0	20433.	54.3	0.0	57.7
2-117-0	3467.7	138.8	0.0	53.0	32945.	138.8	0.0	57.6
2-160-0	4969.9	187.2	0.0	53.0	46421.	187.1	0.0	57.6
2-214-2	1382.7	237.6	-34.6	53.0	12967.	237.5	-35.3	57.6
2-214-1	1382.7	237.6	34.6	53.0	12967.	237.5	35.3	57.6
2-261-2	959.1	284.7	-40.1	53.0	9023.	284.6	-40.6	57.6
2-261-1	959.1	284.7	40.1	53.0	9023.	284.6	40.6	57.6
2-308-2	1109.6	335.2	-40.3	53.0	10380.	335.2	-40.7	57.6
2-308-1	1109.6	335.2	40.3	53.0	10380.	335.2	40.7	57.6
2-362-2	968.2	385.9	-40.2	53.0	9063.	385.9	-40.7	57.6
2-362-1	968.2	385.9	40.2	53.0	9063.	385.9	40.7	57.6

COMPARTMENT NO.	AREA FT2	AREA CENTER X	Y	Z	VOLUME FT3	VOLUME CENTER X	Y	Z
2-410-2	899.0	431.5	-40.2	53.0	8427.	431.5	-40.6	57.6
2-410-1	899.0	431.5	40.2	53.0	8427.	431.5	40.6	57.6
2-454-2	893.2	475.6	-40.1	53.0	8383.	475.6	-40.6	57.6
2-454-1	893.2	475.6	40.1	53.0	8383.	475.6	40.6	57.6
2-498-2	885.9	519.7	-40.0	53.0	8323.	519.7	-40.5	57.6
2-498-1	885.9	519.7	40.0	53.0	8323.	519.7	40.5	57.6
2-542-2	874.4	563.8	-39.9	53.0	8234.	563.8	-40.4	57.6
2-542-1	874.4	563.8	39.9	53.0	8234.	563.8	40.4	57.6
2-586-2	855.6	607.9	-39.7	53.0	8098.	607.9	-40.2	57.6
2-586-1	855.6	607.9	39.7	53.0	8098.	607.9	40.2	57.6
3-FPK-0	671.8	16.3	0.0	44.0	7750.	14.7	0.0	48.8
3- 32-0	1619.6	54.8	0.0	44.0	16470.	54.6	0.0	48.7
3- 74-0	2416.1	96.7	0.0	44.0	51350.	96.5	0.0	53.5
3-117-0	3077.0	139.0	0.0	44.0	29451.	138.9	0.0	48.6
3-214-2	1257.4	237.7	-33.3	44.0	11883.	237.7	-34.0	48.6
3-214-0	1890.0	237.3	0.0	44.0	34022.	237.3	0.0	53.0
3-214-1	1257.4	237.7	33.3	44.0	11883.	237.7	34.0	48.6
3-261-2	865.8	284.8	-39.2	44.0	8213.	284.7	-39.7	48.6
3-261-1	865.8	284.8	39.2	44.0	8213.	284.7	39.7	48.6
3-308-2	1020.1	335.3	-39.4	44.0	9584.	335.3	-39.9	48.6
3-308-1	1020.1	335.3	39.4	44.0	9584.	335.3	39.9	48.6
3-362-2	888.2	385.8	-39.4	44.0	8357.	385.8	-39.8	48.6
3-362-1	888.2	385.8	39.4	44.0	8357.	385.8	39.8	48.6
3-410-2	819.9	431.5	-39.3	44.0	7737.	431.5	-39.8	48.6
3-410-1	819.9	431.5	39.3	44.0	7737.	431.5	39.8	48.6
3-454-2	810.3	475.6	-39.2	44.0	7669.	475.6	-39.7	48.6
3-454-1	810.3	475.6	39.2	44.0	7669.	475.6	39.7	48.6
3-498-2	799.6	519.7	-39.1	44.0	7590.	519.7	-39.6	48.6
3-498-1	799.6	519.7	39.1	44.0	7590.	519.7	39.6	48.6
3-542-2	776.2	563.7	-38.8	44.0	7436.	563.7	-39.4	48.6
3-542-1	776.2	563.7	38.8	44.0	7436.	563.7	39.4	48.6
3-586-2	726.2	607.6	-38.2	44.0	7132.	607.8	-39.0	48.6
3-586-1	726.2	607.6	38.2	44.0	7132.	607.8	39.0	48.6
4-FPK-0	416.8	18.2	0.0	35.0	4917.	16.8	0.0	39.8
4- 32-0	1257.2	55.1	0.0	35.0	12914.	54.9	0.0	39.7
4- 74-0	2030.0	96.9	0.0	35.0	19982.	96.8	0.0	39.6
4-117-0	2719.7	139.1	0.0	35.0	26067.	139.1	0.0	39.6
4-261-2	771.3	285.0	-38.2	35.0	7367.	284.9	-38.7	39.6
4-261-1	771.3	285.0	38.2	35.0	7367.	284.9	38.7	39.6
4-308-2	928.5	335.3	-38.6	35.0	8769.	335.3	-39.0	39.6
4-308-1	928.5	335.3	38.6	35.0	8769.	335.3	39.0	39.6
4-362-2	807.0	385.8	-38.5	35.0	7630.	385.8	-39.0	39.6
4-362-1	807.0	385.8	38.5	35.0	7630.	385.8	39.0	39.6
4-410-2	739.0	431.5	-38.4	35.0	7013.	431.5	-38.8	39.6
4-410-1	739.0	431.5	38.4	35.0	7013.	431.5	38.8	39.6
4-454-2	724.9	475.6	-38.2	35.0	6909.	475.6	-38.7	39.6
4-454-1	724.9	475.6	38.2	35.0	6909.	475.6	38.7	39.6
4-498-2	706.8	519.6	-38.0	35.0	6784.	519.7	-38.6	39.6
4-498-1	706.8	519.6	38.0	35.0	6784.	519.7	38.6	39.6
4-542-2	658.4	563.4	-37.5	35.0	6472.	563.6	-38.2	39.6
4-542-1	658.4	563.4	37.5	35.0	6472.	563.6	38.2	39.6
4-586-2	547.9	607.0	-36.2	35.0	5771.	607.4	-37.3	39.7
4-586-1	547.9	607.0	36.2	35.0	5771.	607.4	37.3	39.7
5-FPK-0	247.5	20.0	0.0	26.0	2963.	18.8	0.0	30.9
5- 32-0	982.2	55.6	0.0	26.0	10008.	55.4	0.0	30.7
5- 74-0	1731.3	97.1	0.0	26.0	16855.	97.0	0.0	30.6
5-117-0	2435.2	139.3	0.0	26.0	23137.	139.2	0.0	30.6

COMPARTMENT NO.	AREA FT2	AREA CENTER X	Y	Z	VOLUME FT3	VOLUME CENTER X	Y	Z
5-214-0	3940.7	237.7	0.0	26.0	74956.	237.6	0.0	35.2
5-261-2	680.9	285.1	-37.2	26.0	6531.	285.0	-37.7	30.6
5-261-0	22142.0	445.5	0.0	26.0	797135.	445.5	0.0	44.0
5-261-1	680.9	285.1	37.2	26.0	6531.	285.0	37.7	30.6
5-308-2	835.2	335.3	-37.7	26.0	7938.	335.3	-38.2	30.6
5-308-1	835.2	335.3	37.7	26.0	7938.	335.3	38.2	30.6
5-362-2	724.1	385.8	-37.7	26.0	6890.	385.8	-38.1	30.6
5-362-1	724.1	385.8	37.7	26.0	6890.	385.8	38.1	30.6
5-410-2	656.5	431.4	-37.4	26.0	6280.	431.4	-37.9	30.6
5-410-1	656.5	431.4	37.4	26.0	6280.	431.4	37.9	30.6
5-454-2	635.3	475.5	-37.2	26.0	6128.	475.5	-37.7	30.6
5-454-1	635.3	475.5	37.2	26.0	6128.	475.5	37.7	30.6
5-498-2	567.5	519.4	-36.4	26.0	5851.	519.5	-37.4	30.7
5-498-1	567.5	519.4	36.4	26.0	5851.	519.5	37.4	30.7
5-542-2	469.5	562.9	-35.4	26.0	5201.	563.2	-36.6	30.7
5-542-1	469.5	562.9	35.4	26.0	5201.	563.2	36.6	30.7
5-586-2	254.2	604.0	-33.2	26.0	3763.	606.1	-35.0	31.0
5-586-1	254.2	604.0	33.2	26.0	3763.	606.1	35.0	31.0
6-FPK-0	139.7	21.7	0.0	17.0	1701.	20.8	0.0	21.9
6- 32-0	746.8	56.1	0.0	17.0	7759.	55.8	0.0	21.7
6- 74-0	1447.6	97.3	0.0	17.0	14317.	97.2	0.0	21.6
6-117-0	2129.6	139.4	0.0	17.0	20596.	139.3	0.0	21.6
6-214-0	3695.2	237.8	0.0	17.0	34409.	237.8	0.0	21.5
6-261-0	4019.0	284.8	0.0	17.0	36970.	284.8	0.0	21.5
6-454-0	3399.5	475.3	0.0	17.0	33564.	475.5	0.0	21.6
6-498-0	2866.6	518.8	0.0	17.0	31492.	519.5	0.0	21.7
6-542-0	1735.3	560.5	0.0	17.0	27821.	563.1	0.0	21.9
6-586-0	148.3	590.7	0.0	17.0	19814.	606.3	0.0	22.7
IB- 32-0	254.6	56.3	0.0	3.0	7229.	56.4	0.0	11.1
IB- 74-0	575.6	98.0	0.0	3.0	15011.	97.5	0.0	10.9
IB-117-0	1039.7	140.2	0.0	3.0	23303.	139.6	0.0	10.8
IB-214-0	2682.2	238.4	0.0	3.0	46080.	238.0	0.0	10.4
IB-261-0	3255.1	285.1	0.0	3.0	52488.	284.9	0.0	10.2
IB-454-0	110.8	457.7	0.0	3.0	26682.	473.7	0.0	12.2
IB-498-0	0.0	0.0	0.0	0.0	12875.	516.2	0.0	14.0
IB-542-0	0.0	0.0	0.0	0.0	3228.	556.4	0.0	15.6
HB-FPK-0					1408.	21.7	0.0	10.3
HB- 32-0					570.	56.2	0.0	2.1
HB- 74-0					1312.	98.3	0.0	2.1
HB-117-0					2546.	140.4	0.0	2.0
HB-160-0					5480.	188.8	0.0	1.9
HB-214-0					6870.	238.4	0.0	1.8
HB-261-0					8290.	285.1	0.0	1.7
HB-308-0					9935.	334.8	0.0	1.8
HB-362-0					6768.	384.2	0.0	1.8
HB-410-0					2750.	426.3	0.0	2.6
HB-454-0					559.	471.4	0.0	7.6
HB-498-0					54.	512.0	0.0	14.6
HB-542-0					7.	557.6	0.0	18.3
HB-586-0					59.	589.5	0.0	16.7

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GIVEN		DKHS SIZE IND-	
DKHS FWD LIMIT-	STA 2.0	DKHS LENGTH OA, FT	299.25
DKHS AFT LIMIT-	STA 11.5	DKHS MAX WIDTH, FT	101.44
DKHS NO PRISMS	9	DKHS HT (W/O PLTHS), FT	102.00
DKHS NO LVLS		DKHS AVG DECK HT, FT	10.00
DKHS AVG SIDE CLR, FT		DKHS ARR AREA AVAIL, FT2	80230.18
DKHS AVG SIDE ANG, DEG		DKHS VOLUME, FT3	802301.81
LBP, FT	630.00	BRIDGE L-O-S OVER BOW, FT	101.90
BEAM, FT	89.95		

PRINTED REPORT NO. 2 - SUPERSTRUCTURE DECKHOUSES

NO OF SS DECKHOUSE BLKS	9
DKHS VOLUME, FT3	802302.
DKHS ARR AREA AVAIL, FT2	80230.2

	DECKHOUSE NUMBER				
	1	2	3	4	5
DIST FROM BOW, FT	94.50	94.50	94.50	94.50	94.50
LENGTH, FT	110.25	110.25	110.25	110.25	20.96
DIST FROM CL, FT					
FWD/PORT/BTM	-38.61	-34.97	-31.33	-27.69	-13.61
AFT/PORT/BTM	-50.72	-47.08	-43.44	-39.80	-17.15
FWD/STBD/BTM	38.61	34.97	31.33	27.69	13.61
AFT/STBD/BTM	50.72	47.08	43.44	39.80	17.15
FWD/PORT/TOP	-34.97	-31.33	-27.69	-24.05	-13.61
AFT/PORT/TOP	-47.08	-43.44	-39.80	-36.16	-17.15
FWD/STBD/TOP	34.97	31.33	27.69	24.05	13.61
AFT/STBD/TOP	47.08	43.44	39.80	36.16	17.15
DIST ABV BASELINE FWD, FT	62.00	72.00	82.00	92.00	102.00
DIST ABV BASELINE AFT, FT	62.00	72.00	82.00	92.00	102.00
HEIGHT, FT	10.00	10.00	10.00	10.00	10.00
VOLUME, FT3	94477.	86452.	78426.	70400.	6449.
ARR AREA, FT2	9447.7	8645.2	7842.6	7040.0	644.9

	DECKHOUSE NUMBER			
	6	7	8	9
DIST FROM BOW, FT	63.00	63.00	204.75	349.65
LENGTH, FT	31.50	31.50	157.50	12.60
DIST FROM CL, FT				
FWD/PORT/BTM	-25.04	-21.40	-50.72	-41.14
AFT/PORT/BTM	-28.61	-24.97	-52.14	-41.14
FWD/STBD/BTM	25.04	21.40	50.72	-17.86
AFT/STBD/BTM	28.61	24.97	52.14	-17.86
FWD/PORT/TOP	-21.40	-17.76	-39.80	-37.50
AFT/PORT/TOP	-24.97	-21.33	-41.22	-37.50
FWD/STBD/TOP	21.40	17.76	39.80	-21.50
AFT/STBD/TOP	24.97	21.33	41.22	-21.50
DIST ABV BASELINE FWD, FT	62.00	72.00	62.00	92.00
DIST ABV BASELINE AFT, FT	62.00	72.00	62.00	92.00
HEIGHT, FT	10.00	10.00	30.00	10.00
VOLUME, FT3	15755.	13462.	434407.	2474.
ARR AREA, FT2	1575.5	1346.2	43440.7	247.4

PRINTED REPORT NO. 3 - DECKHOUSE STRUCTURE WEIGHT SUMMARY

DKHS MTRL TYPE IND-MS
FIRE PROTECT IND-NONE
BLAST RESIST IND-3 PSI

DKHS STRUCT DENSITY, LBM/FT3 4.18
HANGER VOL, FT3 0.

	WT-LTON	VCG-FT	LCG-FT
CALCULATED SWBS150	1497.2	78.30	221.27

DECK HOUSE	VOLUME FT3	VCG FROM BL FT
NO. 1	94477.	66.93
NO. 2	86452.	76.92
NO. 3	78426.	86.91
NO. 4	70400.	96.90
NO. 5	6449.	107.00
NO. 6	15755.	66.88
NO. 7	13462.	76.86
NO. 8	434407.	76.41
NO. 9	2474.	96.69
	802302.	78.30

PRINTED REPORT NO. 1 - HULL STRUCTURE SUMMARY

INNER BOT IND-PRESENT
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

---------------------- HULL STRENGTH AND STRESS ----------------------

HOGGING BM, FT-LTON	409523.	PRIM STRESS KEEL-HOG, KSI	16.67
SAGGING BM, FT-LTON	341418.	PRIM STRESS KEEL-SAG, KSI	13.89
MIDSHIP MOI, FT2-IN2	1645076.	PRIM STRESS DECK-HOG, KSI	17.91
DIST N.A. TO KEEL, FT	29.89	PRIM STRESS DECK-SAG, KSI	14.93
DIST N.A. TO DECK, FT	32.11	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN2	55041.	SEC MOD TO DECK, FT-IN2	51229.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	5	1
SIDE SHELL	HTS	6	1
BOTTOM SHELL	HTS	5	1
INNER BOTTOM	HTS	4	1
INT. DECK	HTS	5	5
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD	HTS		5
TRANS BULKHEAD	HTS		13

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	4702.4	38.48
110	SHELL+SUPPORT	1577.2	28.81
120	HULL STRUCTURAL BHD	818.3	35.06
130	HULL DECKS	718.7	61.96
140	HULL PLATFORM/FLATS	1588.2	39.21

PRINTED REPORT NO. 2 - HULL STRUCTURES WEIGHT

SWBS	COMPONENT	WT-LTON	VCG-FT
100	HULL STRUCTURES	4702.4	38.48
110	SHELL + SUPPORTS	1577.2	28.81
111	PLATING	1024.9	35.61
113	INNER BOTTOM	167.0	3.00
115	STANCHIONS	18.3	31.00
116	LONG FRAMING	101.9	.94
117	TRANS FRAMING	265.1	29.36
120	HULL STRUCTURAL BULKHDS	818.3	35.06
121	LONG BULKHDS	265.7	40.85
122	TRANS BULKHDS	433.7	32.28
123	TRUNKS + ENCLOSURES	118.9	32.28
130	HULL DECKS	718.7	61.96
131	MAIN DECK	718.7	61.96
132	2ND DECK		
133	3RD DECK		
134	4TH DECK		
135	5TH DECK+DECKS BELOW		
136	01 HULL DECK		
140	HULL PLATFORMS/FLATS	1588.2	39.21
141	1ST PLATFORM	458.5	52.93
142	2ND PLATFORM	369.3	43.94
143	3RD PLATFORM	344.4	34.93
144	4TH PLATFORM	298.9	25.95
145	5TH PLAT+PLATS BELOW	117.0	17.05

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 3 - WEATHER DECK

DECK MTRL TYPE-HTS
STRINGER PLATE MTRL TYPE-HTS

	SHELL	STRINGER PLATE
MODULUS OF ELASTICITY, KSI	29600.0	29600.0
DENSITY, LBM/FT3	489.02	489.02
YIELD STRENGTH, KSI	45.00	45.00
MAX PRIMARY STRENGTH, KSI	21.28	21.28
ALLOWABLE WORKING STRENGTH, KSI	38.00	38.00

HULL LOADS IND-CALC

	MAX	MIN
STIFFENER SPACING, IN	24.00	24.00
STRINGER PLATE WIDTH, FT	6.00	

SEGMENT GEOMETRY

	--------NODE COORD, FT			------------------	SCND. LOAD, FT--	
SEG	YIB	ZIB	YOB	ZOB	HEAD1	HEAD2
1	0.00	62.00	10.43	62.00	8.27	
2	10.43	62.00	20.86	62.00	8.27	
3	20.86	62.00	31.29	62.00	8.27	
4	31.29	62.00	41.72	62.00	8.27	
5	41.72	62.00	52.15	62.00	8.27	

SEGMENT SCANTLINGS

SEG	STIFFENERS INXINXIN/IN				CATLG NO	NO.OF STIFF	PLATE TK, IN	SPACING IN
1 *R	3.745X	3.940X	0.170/	0.205	1.	5	0.5625	20.86
2 *R	3.745X	3.940X	0.170/	0.205	1.	5	0.5625	20.86
3 *R	3.745X	3.940X	0.170/	0.205	1.	5	0.5625	20.86
4 *R	3.745X	3.940X	0.170/	0.205	1.	5	0.5625	20.86
5 *R	3.745X	3.940X	0.170/	0.205	1.	5	0.6875	20.86

NOTE: *R STANDS FOR ROLLED SHAPE

SEGMENT PROPERTIES

SEG	AREA TOTAL IN2	AREA SHEAR IN2	N.A. TO PLATE IN	SEC MOD PLATE IN3	SEC MOD FLANGE IN3	WT/FT LBF/FT	SMEAR RATIO
1	13.17	0.77	0.64	25.17	4.14	44.74	0.12
2	13.17	0.77	0.64	25.17	4.14	44.74	0.12
3	13.17	0.77	0.64	25.17	4.14	44.74	0.12
4	13.17	0.77	0.64	25.17	4.14	44.74	0.12
5	15.78	0.79	0.65	26.46	4.29	53.59	0.10

PRINTED REPORT NO. 4 - SIDE SHELL

SIDE SHELL MTRL TYPE-HTS
SHEER STRAKE MTRL TYPE-HTS

	SHELL	SHEER STRAKE
MODULUS OF ELASTICITY, KSI	29600.0	29600.0
DENSITY, LBM/FT3	489.02	489.02
YIELD STRENGTH, KSI	45.00	45.00
MAX PRIMARY STRENGTH, KSI	21.28	21.28
ALLOWABLE WORKING STRENGTH, KSI	38.00	38.00

HULL LOADS IND-CALC

	MAX	MIN
STIFFENER SPACING, IN	24.00	24.00
SHEER STRAKE WIDTH, FT	6.00	

SEGMENT GEOMETRY

SEG	NODE COORD, FT YUPR	ZUPR	YLWR	ZLWR	SCND. LOAD, FT HEAD1	HEAD2
1	52.15	62.00	51.07	56.00	7.81	
2	51.07	56.00	48.80	44.00	16.00	
3	48.80	44.00	47.04	35.00	26.50	
4	47.04	35.00	45.27	26.00	35.50	
5	45.27	26.00	43.52	17.00	44.50	
6	43.52	17.00	42.63	12.40	51.30	

SEGMENT SCANTLINGS

SEG	STIFFENERS INXINXIN/IN				CATLG NO	NO.OF STIFF	PLATE TK, IN	SPACING IN
1 *R	3.745X	3.940X	0.170/	0.205	1.	4	0.6875	18.29
2 *R	3.745X	3.940X	0.170/	0.205	1.	6	0.3438	20.94
3 *R	4.730X	3.960X	0.190/	0.210	2.	4	0.3750	22.01
4 *R	4.730X	3.960X	0.190/	0.210	2.	4	0.4375	22.01

5 *F	5.685X	3.940X	0.170/	0.215	3.	4	0.3438	22.01
6 *F	5.685X	3.940X	0.170/	0.215	3.	3	0.3125	18.74

NOTE: *F STANDS FOR FABRICATED SHAPE
*R STANDS FOR ROLLED SHAPE

SEGMENT PROPERTIES

	PROPERTIES OF STIFFENED PLATES						
	AREA		N.A. TO	SEC MOD			SMEAR
	TOTAL	SHEAR	PLATE	PLATE	FLANGE	WT/FT	RATIO
SEG	IN2	IN2	IN	IN3	IN3	LBF/FT	
1	14.02	0.79	0.69	24.62	4.27	47.60	0.11
2	8.64	0.73	0.70	20.19	3.91	29.33	0.20
3	9.98	1.01	0.84	29.17	5.44	33.90	0.21
4	11.36	1.02	0.79	31.90	5.51	38.58	0.18
5	9.38	1.06	1.02	34.06	6.65	31.84	0.24
6	7.67	1.06	1.19	27.76	6.57	26.03	0.31

PRINTED REPORT NO. 5 - BOTTOM SHELL

BOTTOM SHELL MTRL TYPE-HTS

MODULUS OF ELASTICITY, KSI	29600.0
DENSITY, LBM/FT3	489.02
YIELD STRENGTH, KSI	45.00
MAX PRIMARY STRENGTH, KSI	21.28
ALLOWABLE WORKING STRENGTH, KSI	38.00

HULL LOADS IND-CALC

	MAX	MIN
STIFFENER SPACING, IN	24.00	24.00

SEGMENT GEOMETRY

	NODE COORD, FT				SCND. LOAD, FT	
SEG	YUPR	ZUPR	YLWR	ZLWR	HEAD1	HEAD2
1	42.63	12.40	36.57	3.00	58.93	
2	36.57	3.00	31.29	0.96	64.26	
3	31.29	0.96	20.86	0.53	65.34	
4	20.86	0.53	10.43	0.25	65.70	
5	10.43	0.25	0.00	0.00	72.22	

SEGMENT SCANTLINGS

	SCANTLINGS OF STIFFENED PLATES							
	STIFFENERS				CATLG	NO.OF	PLATE	SPACING
SEG	INXINXIN/IN				NO	STIFF	TK, IN	IN
1 *F	9.660X	3.960X	0.190/	0.210	14.	5	0.4375	22.99
2 *F	9.660X	3.960X	0.190/	0.210	14.	2	0.4375	22.00
3 *F	9.660X	3.960X	0.190/	0.210	14.	3	0.5000	21.64
4 *F	9.660X	3.960X	0.190/	0.210	14.	5	0.5000	20.73
5 *F	9.660X	3.960X	0.190/	0.210	14.	6	0.5000	22.20

NOTE: *F STANDS FOR FABRICATED SHAPE

SEGMENT PROPERTIES

	PROPERTIES OF STIFFENED PLATES						
	AREA		N.A. TO	SEC MOD			SMEAR
	TOTAL	SHEAR	PLATE	PLATE	FLANGE	WT/FT	RATIO
SEG	IN2	IN2	IN	IN3	IN3	LBF/FT	
1	12.73	1.96	1.60	74.93	13.78	43.23	0.27
2	12.29	1.96	1.65	72.18	13.76	41.75	0.28
3	13.49	1.97	1.56	78.37	13.88	45.81	0.25
4	13.03	1.97	1.61	75.62	13.86	44.26	0.26
5	13.77	1.97	1.53	80.05	13.89	46.77	0.24

PRINTED REPORT NO. 6 - INNER BOTTOM

INNER BOT IND-PRESENT

INNER BOTTOM MTRL TYPE-HTS

MODULUS OF ELASTICITY, KSI	29600.0
DENSITY, LBM/FT3	489.02
YIELD STRENGTH, KSI	45.00
MAX PRIMARY STRENGTH, KSI	21.28
ALLOWABLE WORKING STRENGTH, KSI	38.00

HULL LOADS IND-CALC

	MAX	MIN
STIFFENER SPACING, IN	24.00	24.00

SEGMENT GEOMETRY

	NODE COORD, FT				SCND. LOAD, FT	
SEG	YUPR	ZUPR	YLWR	ZLWR	HEAD1	HEAD2
1	36.57	3.00	31.29	3.00	2.83	68.34
2	31.29	3.00	20.86	3.00	2.82	64.41
3	20.86	3.00	10.43	3.00	2.82	59.19
4	10.43	3.00	0.00	3.00	2.82	53.98

SEGMENT SCANTLINGS

	SCANTLINGS OF STIFFENED PLATES							
	STIFFENERS				CATLG	NO.OF	PLATE	SPACING
SEG	INXINXIN/IN				NO	STIFF	TK, IN	IN
1 *F	5.685X	3.940X	0.170/	0.215	3.	2	0.3750	21.13
2 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.4375	20.86
3 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.4375	20.86
4 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.4375	20.86

NOTE: *F STANDS FOR FABRICATED SHAPE
*R STANDS FOR ROLLED SHAPE

SEGMENT PROPERTIES

	PROPERTIES OF STIFFENED PLATES						
	AREA		N.A. TO	SEC MOD			SMEAR
	TOTAL	SHEAR	PLATE	PLATE	FLANGE	WT/FT	RATIO
SEG	IN2	IN2	IN	IN3	IN3	LBF/FT	
1	9.73	1.07	1.01	34.96	6.68	33.06	0.23
2	10.86	1.02	0.82	30.64	5.51	36.87	0.19
3	10.86	1.02	0.82	30.64	5.51	36.87	0.19
4	10.86	1.02	0.82	30.64	5.51	36.87	0.19

PRINTED REPORT NO. 7 - INTERNAL DECKS

NUMBER OF INTERNAL DECKS 5

INTERNAL DECK MTRL TYPE-HTS

MODULUS OF ELASTICITY, KSI	29600.0
DENSITY, LBM/FT3	489.02
YIELD STRENGTH, KSI	45.00
MAX PRIMARY STRENGTH, KSI	21.28
ALLOWABLE WORKING STRENGTH, KSI	38.00

HULL LOADS IND-CALC

	MAX	MIN
STIFFENER SPACING, IN	24.00	24.00

SEGMENT GEOMETRY

	--------NODE COORD, FT			-------------------	-SCND. LOAD, FT--	
SEG	YIB	ZIB	YOB	ZOB	HEAD1	HEAD2
DECK NO.1						
SEG						
1	0.00	53.00	10.43	53.00	2.67	41.70
2	10.43	53.00	20.86	53.00	2.67	46.92
3	20.86	53.00	31.29	53.00	2.67	52.13
4	31.29	53.00	41.72	53.00	2.67	57.80
5	41.72	53.00	50.51	53.00	2.67	45.70
DECK NO.2						
SEG						
1	0.00	44.00	10.43	44.00	2.67	41.70
2	10.43	44.00	20.86	44.00	2.67	46.92
3	20.86	44.00	31.29	44.00	2.67	52.13
4	31.29	44.00	41.72	44.00	2.67	57.80
5	41.72	44.00	48.80	44.00	2.67	45.70
DECK NO.3						
SEG						
1	0.00	35.00	10.43	35.00	2.67	41.70
2	10.43	35.00	20.86	35.00	2.67	46.92
3	20.86	35.00	31.29	35.00	2.67	52.13
4	31.29	35.00	41.72	35.00	2.67	57.80
5	41.72	35.00	47.04	35.00	2.67	45.70
DECK NO.4						
SEG						
1	0.00	26.00	10.43	26.00	2.67	41.70
2	10.43	26.00	20.86	26.00	2.67	46.92
3	20.86	26.00	31.29	26.00	2.67	52.13
4	31.29	26.00	45.27	26.00	2.67	57.80
DECK NO.5						
SEG						
1	0.00	17.00	10.43	17.00	2.67	41.70
2	10.43	17.00	20.86	17.00	2.67	46.92
3	20.86	17.00	31.29	17.00	2.67	52.13
4	31.29	17.00	43.52	17.00	2.67	57.80

SEGMENT SCANTLINGS

SEG	STIFFENERS INXINXIN/IN				CATLG NO	NO.OF STIFF	PLATE TK, IN	SPACING IN
DECK NO.1								
SEG								
1 *R	3.745X	3.940X	0.170/	0.205	1.	5	0.2813	20.86
2 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
3 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
4 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3438	20.86
5 *R	3.745X	3.940X	0.170/	0.205	1.	4	0.5000	21.10
DECK NO.2								
SEG								
1 *R	3.745X	3.940X	0.170/	0.205	1.	5	0.2813	20.86
2 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
3 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
4 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3438	20.86
5 *R	3.745X	3.940X	0.170/	0.205	1.	3	0.5000	21.23
DECK NO.3								
SEG								
1 *R	3.745X	3.940X	0.170/	0.205	1.	5	0.2813	20.86
2 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
3 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
4 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3438	20.86
5 *R	3.745X	3.940X	0.170/	0.205	1.	2	0.5000	21.27
DECK NO.4								
SEG								
1 *R	3.745X	3.940X	0.170/	0.205	1.	5	0.2813	20.86
2 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
3 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
4 *F	5.685X	3.940X	0.170/	0.215	3.	6	0.3438	23.97
DECK NO.5								
SEG								
1 *R.	3.745X	3.940X	0.170/	0.205	1.	5	0.2813	20.86
2 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
3 *R	4.730X	3.960X	0.190/	0.210	2.	5	0.3125	20.86
4 *R	4.730X	3.960X	0.190/	0.210	2.	6	0.3438	20.96

(Header above the table: ----------------SCANTLINGS OF STIFFENED PLATES----------------)

NOTE: *F STANDS FOR FABRICATED SHAPE
*R STANDS FOR ROLLED SHAPE

SEGMENT PROPERTIES

----------------PROPERTIES OF STIFFENED PLATES-----------------

SEG	AREA TOTAL IN2	AREA SHEAR IN2	N.A. TO PLATE IN	SEC MOD PLATE IN3	SEC MOD FLANGE IN3	WT/FT LBF/FT	SMEAR RATIO
DECK NO.1							
SEG							
1	7.31	0.72	0.76	17.72	3.85	24.82	0.25
2	8.25	1.00	0.93	24.77	5.35	28.01	0.27
3	8.25	1.00	0.93	24.77	5.35	28.01	0.27
4	8.90	1.00	0.90	26.44	5.39	30.23	0.24
5	11.99	0.76	0.64	24.36	4.08	40.71	0.14
DECK NO.2							
SEG							
1	7.31	0.72	0.76	17.72	3.85	24.82	0.25
2	8.25	1.00	0.93	24.77	5.35	28.01	0.27
3	8.25	1.00	0.93	24.77	5.35	28.01	0.27
4	8.90	1.00	0.90	26.44	5.39	30.23	0.24
5	12.05	0.76	0.64	24.45	4.08	40.93	0.14

DECK NO.3							
SEG							
1	7.31	0.72	0.76	17.72	3.85	24.82	0.25
2	8.25	1.00	0.93	24.77	5.35	28.01	0.27
3	8.25	1.00	0.93	24.77	5.35	28.01	0.27
4	8.90	1.00	0.90	26.44	5.39	30.23	0.24
5	12.07	0.76	0.64	24.48	4.08	41.00	0.14
DECK NO.4							
SEG							
1	7.31	0.72	0.76	17.72	3.85	24.82	0.25
2	8.25	1.00	0.93	24.77	5.35	28.01	0.27
3	8.25	1.00	0.93	24.77	5.35	28.01	0.27
4	10.05	1.06	0.96	36.54	6.66	34.13	0.22
DECK NO.5							
SEG							
1	7.31	0.72	0.76	17.72	3.85	24.82	0.25
2	8.25	1.00	0.93	24.77	5.35	28.01	0.27
3	8.25	1.00	0.93	24.77	5.35	28.01	0.27
4	8.94	1.00	0.89	26.54	5.39	30.35	0.24

PRINTED REPORT NO. 8 - STRENGTH AND STRESS OF STIFFENED PLATE AT DESIGN LOAD

INNER BOT IND-PRESENT

SEG	-PRIMARY STRESS-		-LOCAL STRESS-		--------STRENGTH--------		
	TENSION KSI	COMP. KSI	BEND. KSI	SHEAR KSI	BUCKL. KSI	ULTIMATE KSI	COLUMN KSI
WET DECK							
1	18.86	15.72	6.35	2.14	42.38	43.12	29.94
2	18.86	15.72	6.35	2.14	42.38	43.12	29.94
3	18.86	15.72	6.35	2.14	42.38	43.12	29.94
4	18.86	15.72	6.35	2.14	42.38	43.12	29.94
5	18.86	15.72	6.13	2.08	43.79	45.00	28.41
SIDE SHELL							
1	17.97	15.06	5.10	1.73	44.28	45.00	29.78
2	15.35	13.11	13.05	4.37	28.86	32.67	33.41
3	12.28	10.82	16.35	5.50	31.07	33.50	37.46
4	9.65	8.86	21.60	7.29	37.21	37.00	36.61
5	10.83	11.10	22.45	8.79	26.12	31.54	40.87
6	11.99	13.09	22.29	8.67	29.76	33.02	41.94
BOT SHELL							
1	13.29	15.32	14.99	6.59	36.02	36.02	45.00
2	14.20	16.88	15.66	6.88	37.23	37.01	45.00
3	14.38	17.19	15.53	6.84	40.37	40.25	45.00
4	14.44	17.30	14.98	6.58	41.04	41.11	45.00
5	15.56	19.21	17.59	7.75	39.93	39.72	45.00
INNER BOT							
1	13.98	16.51	32.94	12.90	33.70	34.43	40.69
2	13.98	16.51	37.19	12.53	38.50	38.19	36.97
3	13.98	16.51	34.18	11.51	38.50	38.19	36.97
4	13.98	16.51	31.16	10.50	38.50	38.19	36.97

INT DECK NO. 1							
1	0.00	0.00	34.43	11.52	19.46	28.29	34.67
2	0.00	0.00	27.87	9.34	24.02	30.60	38.67
3	0.00	0.00	30.97	10.38	24.02	30.60	38.67
4	0.00	0.00	34.08	11.44	29.07	32.75	38.22
5	0.00	0.00	36.05	12.14	40.78	40.76	30.72
INT DECK NO. 2							
1	0.00	0.00	34.43	11.52	19.46	28.29	34.67
2	0.00	0.00	27.87	9.34	24.02	30.60	38.67
3	0.00	0.00	30.97	10.38	24.02	30.60	38.67
4	0.00	0.00	34.08	11.44	29.07	32.75	38.22
5	0.00	0.00	36.27	12.22	40.68	40.64	30.66
INT DECK NO. 3							
1	0.00	0.00	34.43	11.52	19.46	28.29	34.67
2	0.00	0.00	27.87	9.34	24.02	30.60	38.67
3	0.00	0.00	30.97	10.38	24.02	30.60	38.67
4	0.00	0.00	34.08	11.44	29.07	32.75	38.22
5	0.00	0.00	36.33	12.24	40.65	40.60	30.64
INT DECK NO. 4							
1	0.00	0.00	34.43	11.52	19.46	28.29	34.67
2	0.00	0.00	27.87	9.34	24.02	30.60	38.67
3	0.00	0.00	30.97	10.38	24.02	30.60	38.67
4	0.00	0.00	31.69	12.43	22.02	29.64	40.45
INT DECK NO. 5							
1	0.00	0.00	34.43	11.52	19.46	28.29	34.67
2	0.00	0.00	27.87	9.34	24.02	30.60	38.67
3	0.00	0.00	30.97	10.38	24.02	30.60	38.67
4	0.00	0.00	34.25	11.50	28.78	32.63	38.19

PRINTED REPORT NO. 9 - FACTOR OF SAFETY OF STIFFENED PLATE AT DESIGN LOAD

INNER BOT IND-PRESENT

	--PLATE-	-STIFFENER-	--------STIFFENED PLATE-----------		
SEG	BUCKLING	SHEAR	COMP+BEND	ULTIMATE	TENSION+BEND.
WET DECK					
1	2.61	10.65	1.05	1.41	1.51
2	2.61	10.65	1.05	1.41	1.51
3	2.61	10.65	1.05	1.41	1.51
4	2.61	10.65	1.05	1.41	1.51
5	2.70	10.94	1.01	1.40	1.52
SIDE SHELL					
1	2.85	13.21	1.12	1.54	1.65
2	2.00	5.21	1.08	1.35	1.34
3	2.51	4.14	1.16	1.80	1.33
4	3.45	3.13	1.08	2.23	1.22
5	1.96	2.59	1.07	1.72	1.14
6	1.88	2.63	1.02	1.56	1.11

BOT SHELL					
1	2.15	3.46	1.22	1.72	1.34
2	2.02	3.32	1.14	1.61	1.27
3	2.17	3.34	1.13	1.73	1.27
4	2.19	3.46	1.14	1.76	1.29
5	1.92	2.94	1.00	1.53	1.15
INNER BOT					
1	10.42	1.77	1.15	7.70	1.15
2	11.22	1.82	1.02	7.31	1.02
3	12.21	1.98	1.11	7.96	1.11
4	13.38	2.17	1.22	8.72	1.22
INT DECK NO. 1					
1	5.06	1.98	1.10	4.54	1.10
2	7.76	2.44	1.36	6.80	1.36
3	6.99	2.20	1.23	6.12	1.23
4	8.14	1.99	1.12	6.23	1.12
5	13.16	1.88	1.05	7.19	1.05
INT DECK NO. 2					
1	5.06	1.98	1.10	4.54	1.10
2	7.76	2.44	1.36	6.80	1.36
3	6.99	2.20	1.23	6.12	1.23
4	8.14	1.99	1.12	6.23	1.12
5	13.10	1.87	1.05	7.13	1.05
INT DECK NO. 3					
1	5.06	1.98	1.10	4.54	1.10
2	7.76	2.44	1.36	6.80	1.36
3	6.99	2.20	1.23	6.12	1.23
4	8.14	1.99	1.12	6.23	1.12
5	13.09	1.86	1.05	7.12	1.05
INT DECK NO. 4					
1	5.06	1.98	1.10	4.54	1.10
2	7.76	2.44	1.36	6.80	1.36
3	6.99	2.20	1.23	6.12	1.23
4	7.42	1.83	1.20	7.18	1.20
INT DECK NO. 5					
1	5.06	1.98	1.10	4.54	1.10
2	7.76	2.44	1.36	6.80	1.36
3	6.99	2.20	1.23	6.12	1.23
4	8.05	1.98	1.11	6.20	1.11

PRINTED REPORT NO. 10 - GIRDER PROPERTIES, STRENGTH ,STRESSES AND FACTOR OF SAFETY

DECK MTRL TYPE-HTS
BOT MTRL TYPE-HTS

HULL LOADS IND-CALC
GIRDER/STIFF.,POSITION

	------COORDINATE, FT-----		--SCND. LOAD, FT--	
	YLOC	ZLOC	HEAD1	HEAD2
WET DECK				
GIRDER				
1	0.00	62.00	8.77	
2	10.43	62.00	8.77	
3	20.86	62.00	8.77	
4	31.29	62.00	8.77	
5	41.72	62.00	8.77	
INT DECK 1.				
GIRDER				
1	0.00	53.00	2.81	8.06
2	10.43	53.00	2.81	13.27
3	20.86	53.00	2.86	18.54
4	31.29	53.00	2.86	23.76
5	41.72	53.00	2.92	29.03
INT DECK 2.				
GIRDER				
1	0.00	44.00	2.81	15.85
2	10.43	44.00	2.81	21.07
3	20.86	44.00	2.86	26.34
4	31.29	44.00	2.86	31.55
5	41.72	44.00	2.92	36.82
INT DECK 3.				
GIRDER				
1	0.00	35.00	2.81	23.65
2	10.43	35.00	2.81	28.86
3	20.86	35.00	2.86	34.13
4	31.29	35.00	2.86	39.35
5	41.72	35.00	2.92	44.61
INT DECK 4.				
GIRDER				
1	0.00	26.00	2.81	31.44
2	10.43	26.00	2.81	36.66
3	20.86	26.00	2.86	41.92
4	31.29	26.00	2.86	47.14
INT DECK 5.				
GIRDER				
1	0.00	17.00	2.81	39.24
2	10.43	17.00	2.81	44.45
3	20.86	17.00	2.86	49.72
4	31.29	17.00	2.86	54.93
BOTTOM				
GIRDER				
1	0.00	0.00	0.43	66.00
2	10.43	0.25	0.43	65.75
3	20.86	0.53	0.43	65.47
4	31.29	0.96	0.37	68.66

BOTTOM STIFF.				
1	0.00	1.50	0.37	64.50
2	10.43	1.63	0.37	64.37
3	20.86	1.76	0.37	64.24
4	31.29	1.98	0.32	67.73

---------------SCANTLINGS OF GDR/STF AND PLATE-------------

	GIRDER/STIFFENER ------------INXINXIN/IN------------				CATLG NO	PLATE TK, IN	SUPPORT WIDTH IN
WET DECK GIRDER							
1 *F	15.345X	5.500X	0.250/	0.345	51.	0.5625	125.16
2 *F	15.345X	5.500X	0.250/	0.345	51.	0.5625	125.16
3 *F	15.345X	5.500X	0.250/	0.345	51.	0.5625	125.16
4 *F	15.345X	5.500X	0.250/	0.345	51.	0.5625	125.16
5 *F	15.345X	5.500X	0.250/	0.345	51.	0.5625	125.16
INT DECK 1.							
GIRDER							
1 *F	9.720X	4.000X	0.230/	0.270	25.	0.2813	125.16
2 *F	11.810X	4.010X	0.235/	0.350	35.	0.2813	125.16
3 *F	11.840X	6.490X	0.230/	0.380	45.	0.3125	125.16
4 *F	15.345X	5.500X	0.250/	0.345	51.	0.3125	125.16
5 *F	11.980X	6.560X	0.300/	0.520	63.	0.3438	115.32
INT DECK 2.							
GIRDER							
1 *F	11.885X	4.030X	0.260/	0.425	41.	0.2813	125.16
2 *F	13.490X	5.030X	0.255/	0.420	49.	0.2813	125.16
3 *F	11.980X	6.560X	0.300/	0.520	63.	0.3125	125.16
4 *F	15.430X	6.990X	0.295/	0.430	67.	0.3125	125.16
5 *F	15.430X	6.990X	0.295/	0.430	67.	0.3438	105.03
INT DECK 3.							
GIRDER							
1 *F	15.345X	5.500X	0.250/	0.345	51.	0.2813	125.16
2 *F	15.430X	6.990X	0.295/	0.430	67.	0.2813	125.16
3 *F	15.430X	6.990X	0.295/	0.430	67.	0.3125	125.16
4 *F	15.505X	7.000X	0.305/	0.505	71.	0.3125	125.16
5 *F	15.430X	6.990X	0.295/	0.430	67.	0.3438	94.48
INT DECK 4.							
GIRDER							
1 *F	15.430X	6.990X	0.295/	0.430	67.	0.2813	125.16
2 *F	17.275X	6.000X	0.300/	0.425	69.	0.2813	125.16
3 *F	17.375X	6.020X	0.315/	0.525	75.	0.3125	125.16
4 *F	17.420X	7.500X	0.355/	0.570	81.	0.3125	146.46
INT DECK 5.							
GIRDER							
1 *F	15.505X	7.000X	0.305/	0.505	71.	0.2813	125.16
2 *F	15.565X	7.040X	0.345/	0.565	77.	0.2813	125.16
3 *F	17.420X	7.500X	0.355/	0.570	81.	0.3125	125.16
4 *F	20.375X	8.240X	0.400/	0.615	87.	0.3125	135.96
BOTTOM GIRDER							
1	36.000X	21.875X	0.438/	0.438		0.5000	155.41
2	32.989X	21.875X	0.438/	0.438		0.5000	139.88
3	29.659X	21.875X	0.438/	0.438		0.5000	105.45
4	24.447X	18.750X	0.375/	0.375		0.4375	86.55

BOTTOM
STIFF.

1 *F	5.685X	3.940X	0.170/	0.215	3.	0.4375	18.00
2 *F	5.685X	3.940X	0.170/	0.215	3.	0.4375	18.00
3 *F	5.685X	3.940X	0.170/	0.215	3.	0.4375	18.00
4 *F	5.685X	3.940X	0.170/	0.215	3.	0.3750	18.00

NOTE: *F STANDS FOR FABRICATED SHAPE

----------------PROPERTIES OF GDR/STF AND PLATES----------------

	------AREA------		N.A. TO	-----SEC MOD-----			SMEAR
	TOTAL	SHEAR	PLATE	PLATE	FLANGE	WT/FT	RATIO
	IN2	IN2	IN	IN3	IN3	LBF/FT	
WET DECK GIRDER							
1	76.13	4.06	1.08	691.59	49.00	258.55	0.08
2	76.13	4.06	1.08	691.59	49.00	258.55	0.08
3	76.13	4.06	1.08	691.59	49.00	258.55	0.08
4	76.13	4.06	1.08	691.59	49.00	258.55	0.08
5	76.13	4.06	1.08	691.59	49.00	258.55	0.08
INT DECK 1. GIRDER							
1	38.53	2.36	0.71	237.65	17.70	130.84	0.09
2	39.39	2.92	1.00	311.53	27.21	133.76	0.12
3	44.30	2.88	1.21	372.10	39.69	150.45	0.13
4	44.84	4.00	1.49	468.07	48.00	152.28	0.15
5	46.66	3.85	1.55	396.19	54.55	158.45	0.18
INT DECK 2. GIRDER							
1	40.01	3.27	1.13	324.27	32.10	135.87	0.14
2	40.76	3.62	1.44	383.05	43.21	138.41	0.16
3	46.12	3.84	1.55	394.92	54.45	156.63	0.18
4	46.67	4.77	1.94	501.67	68.47	158.50	0.19
5	43.67	4.78	2.08	463.83	68.44	148.31	0.21
INT DECK 3. GIRDER							
1	40.94	3.99	1.60	430.29	47.83	139.02	0.16
2	42.77	4.76	2.09	459.34	68.21	145.24	0.21
3	46.67	4.77	1.94	501.67	68.47	158.50	0.19
4	47.37	4.98	2.13	516.14	77.58	160.88	0.21
5	40.04	4.78	2.26	421.82	68.25	135.98	0.23
INT DECK 4. GIRDER							
1	42.77	4.76	2.09	459.34	68.21	145.24	0.21
2	42.94	5.39	2.25	503.13	71.86	145.82	0.22
3	47.74	5.74	2.35	569.44	84.21	162.13	0.22
4	56.23	6.50	2.49	683.14	107.58	190.95	0.23
INT DECK 5. GIRDER							
1	43.47	4.97	2.29	472.03	77.28	147.62	0.23
2	44.55	5.66	2.52	479.34	86.98	151.28	0.27
3	49.57	6.50	2.80	592.11	107.11	168.35	0.27
4	55.71	8.52	3.57	759.29	152.64	189.18	0.31
BOTTOM GIRDER							
1	36.26	16.16	17.80	477.62	444.41	123.13	0.00
2	34.94	14.84	16.33	430.71	399.75	118.66	0.00
3	33.48	13.39	14.70	380.33	351.93	113.71	0.00
4	24.40	9.47	12.05	232.34	212.10	82.87	0.00

BOTTOM STIFF.							
1	9.68	1.08	1.05	33.98	6.73	32.89	0.23
2	9.68	1.08	1.05	33.98	6.73	32.89	0.23
3	9.68	1.08	1.05	33.98	6.73	32.89	0.23
4	8.56	1.07	1.12	30.64	6.65	29.07	0.27

-----------------STRENGTH AND STRESSES OF GDR.STF------------
AT DESIGN LOAD

	-PRIMARY STRESS-		-LOCAL STRESS-		--------STRENGTH--------		
	TENSION KSI	COMP. KSI	BEND. KSI	SHEAR KSI	BUCKL. KSI	ULTIMATE KSI	COLUMN KSI
WET DECK GIRDER							
1	18.86	15.72	13.23	5.07	28.40	32.49	37.75
2	18.86	15.72	13.23	5.07	28.40	32.49	37.75
3	18.86	15.72	13.23	5.07	28.40	32.49	37.75
4	18.86	15.72	13.23	5.07	28.40	32.49	37.75
5	18.86	15.72	13.23	5.07	28.40	32.49	37.75
INT DECK 1.							
GIRDER							
1	0.00	0.00	33.66	8.01	40.75	40.73	28.99
2	0.00	0.00	36.08	10.66	37.24	37.02	35.76
3	0.00	0.00	34.55	15.10	36.60	36.48	38.08
4	0.00	0.00	36.59	13.94	28.40	32.49	41.44
5	0.00	0.00	36.25	16.29	41.55	41.83	40.24
INT DECK 2.							
GIRDER							
1	0.00	0.00	36.52	11.37	39.38	39.10	37.20
2	0.00	0.00	36.06	13.67	35.83	35.87	40.42
3	0.00	0.00	35.77	16.08	41.55	41.83	40.29
4	0.00	0.00	34.07	15.52	36.16	36.12	43.38
5	0.00	0.00	33.39	15.17	36.16	36.12	43.73
INT DECK 3.							
GIRDER							
1	0.00	0.00	36.56	13.90	28.40	32.49	41.98
2	0.00	0.00	31.29	14.23	36.16	36.12	43.81
3	0.00	0.00	36.86	16.79	36.16	36.12	43.38
4	0.00	0.00	37.50	18.55	36.94	36.76	44.02
5	0.00	0.00	36.49	16.54	36.16	36.12	44.15
INT DECK 4.							
GIRDER							
1	0.00	0.00	34.08	15.50	36.16	36.12	43.81
2	0.00	0.00	37.72	15.95	32.27	33.94	44.72
3	0.00	0.00	36.81	17.15	34.55	34.92	45.00
4	0.00	0.00	37.91	19.93	37.84	37.55	45.00
INT DECK 5.							
GIRDER							
1	0.00	0.00	37.54	18.54	36.94	36.76	44.41
2	0.00	0.00	37.79	18.43	39.64	39.38	44.88
3	0.00	0.00	34.32	17.96	37.84	37.55	45.00
4	0.00	0.00	28.91	16.44	36.89	36.72	45.00
BOTTOM GIRDER							
1	14.50	17.39	13.64	11.90	41.15	41.26	45.00
2	14.45	17.31	13.59	11.62	42.21	42.85	45.00
3	14.41	17.23	11.59	9.67	43.14	44.41	45.00
4	14.33	17.11	16.55	11.77	43.40	44.84	45.00

BOTTOM STIFF.							
1	14.24	16.95	26.28	10.27	43.23	44.57	40.82
2	14.22	16.91	26.22	10.25	43.23	44.57	40.82
3	14.19	16.87	26.17	10.22	43.23	44.57	40.82
4	14.16	16.81	27.93	10.89	43.23	44.57	41.44

-------------------FACTOR OF SAFETY OF GDR.STF-----------
AT DESIGN LOAD

	--PLATE- BUCKLING	-STIFFENER- SHEAR	--------STIFFENED PLATE----------- COMP+BEND	ULTIMATE	TENSION+BEND.
WET DECK GIRDER					
1	1.75	4.50	1.03	1.35	1.18
2	1.75	4.50	1.03	1.35	1.18
3	1.75	4.50	1.03	1.35	1.18
4	1.75	4.50	1.03	1.35	1.18
5	1.75	4.50	1.03	1.35	1.18
INT DECK	1.				
GIRDER					
1	31.65	2.85	1.13	16.30	1.13
2	23.02	2.14	1.05	14.55	1.05
3	19.35	1.51	1.10	13.05	1.10
4	14.74	1.64	1.04	12.42	1.04
5	16.21	1.40	1.05	11.67	1.05
INT DECK	2.				
GIRDER					
1	21.22	2.01	1.04	13.93	1.04
2	17.16	1.67	1.05	12.34	1.05
3	16.41	1.42	1.06	11.83	1.06
4	15.14	1.47	1.12	11.67	1.12
5	14.30	1.50	1.14	11.10	1.14
INT DECK	3.				
GIRDER					
1	13.61	1.64	1.04	11.62	1.04
2	15.16	1.60	1.21	11.79	1.21
3	14.00	1.36	1.03	10.78	1.03
4	12.76	1.23	1.01	9.94	1.01
5	11.93	1.38	1.04	9.35	1.04
INT DECK	4.				
GIRDER					
1	13.91	1.47	1.11	10.82	1.11
2	11.67	1.43	1.01	9.75	1.01
3	12.36	1.33	1.03	9.99	1.03
4	12.34	1.14	1.00	9.80	1.00
INT DECK	5.				
GIRDER					
1	11.70	1.23	1.01	9.20	1.01
2	11.26	1.24	1.01	8.92	1.01
3	11.87	1.27	1.11	9.42	1.11
4	12.36	1.39	1.31	9.84	1.31
BOTTOM GIRDER					
1	6.32	1.92	2.79	5.07	2.79
2	6.52	1.96	2.80	5.29	2.80
3	7.83	2.36	3.28	6.45	3.28
4	5.59	1.94	2.30	4.62	2.30

BOTTOM STIFF.

1	16.17	2.22	1.45	12.09	1.45
2	16.20	2.23	1.45	12.12	1.45
3	16.23	2.23	1.45	12.14	1.45
4	13.88	2.09	1.36	10.54	1.36

PRINTED REPORT NO. 11 - LONGITUDINAL BULKHEADS

NUMBER OF LONG BHD 5

LONG BHD MTRL TYPE-HTS

MODULUS OF ELASTICITY, KSI	29600.0
DENSITY, LBM/FT3	489.02
YIELD STRENGTH, KSI	45.00
MAX PRIMARY STRENGTH, KSI	21.28
ALLOWABLE WORKING STRENGTH, KSI	38.00

HULL LOADS IND-CALC

	MAX	MIN
STIFFENER SPACING, IN	24.00	24.00

SEGMENT GEOMETRY

	--------NODE COORD, FT			-------------------	SCND. LOAD, FT--	
SEG	YUPR	ZUPR	YLWR	ZLWR	HEAD1	HEAD2
BHD NO.1						
SEG						
1	30.00	62.00	30.00	53.00	22.75	
2	30.00	53.00	30.00	44.00	30.54	
3	30.00	44.00	30.00	35.00	38.34	
4	30.00	35.00	30.00	26.00	46.13	
BHD NO.2						
SEG						
1	30.00	62.00	30.00	53.00	22.75	
2	30.00	53.00	30.00	44.00	30.54	
3	30.00	44.00	30.00	35.00	38.34	
4	30.00	35.00	30.00	26.00	46.13	
BHD NO.3						
SEG						
1	20.00	62.00	20.00	53.00	17.75	
2	20.00	53.00	20.00	44.00	25.54	
BHD NO.4						
SEG						
1	20.00	62.00	20.00	53.00	17.75	
2	20.00	53.00	20.00	44.00	25.54	
BHD NO.5						
SEG						
1	0.00	26.00	0.00	17.00	38.93	
2	0.00	17.00	0.00	3.00	51.05	

SEGMENT SCANTLINGS

SEG	STIFFENERS INXINXIN/IN				CATLG NO	NO.OF STIFF	PLATE TK, IN	SPACING IN
BHD NO.1								
SEG								
1 *R	3.745X	3.940X	0.170/	0.205	1	4	0.3438	21.60
2 *R	3.745X	3.940X	0.170/	0.205	1	4	0.4375	21.60
3 *R	3.745X	3.940X	0.170/	0.205	1	4	0.4375	21.60
4 *R	3.745X	3.940X	0.170/	0.205	1	4	0.5000	21.60
BHD NO.2								
SEG								
1 *R	3.745X	3.940X	0.170/	0.205	1	4	0.3438	21.60
2 *R	3.745X	3.940X	0.170/	0.205	1	4	0.4375	21.60
3 *R	3.745X	3.940X	0.170/	0.205	1	4	0.4375	21.60
4 *R	3.745X	3.940X	0.170/	0.205	1	4	0.5000	21.60
BHD NO.3								
SEG								
1 *R	3.745X	3.940X	0.170/	0.205	1	4	0.3125	21.60
2 *R	3.745X	3.940X	0.170/	0.205	1	4	0.3438	21.60
BHD NO.4								
SEG								
1 *R	3.745X	3.940X	0.170/	0.205	1	4	0.3125	21.60
2 *R	3.745X	3.940X	0.170/	0.205	1	4	0.3438	21.60
BHD NO.5								
SEG								
1 *R	3.745X	3.940X	0.170/	0.205	1	4	0.2813	21.60
2 *R	4.730X	3.960X	0.190/	0.210	2	6	0.3438	24.00

NOTE: *R STANDS FOR ROLLED SHAPE

SEGMENT PROPERTIES

SEG	AREA TOTAL IN2	AREA SHEAR IN2	N.A. TO PLATE IN	SEC MOD PLATE IN3	SEC MOD FLANGE IN3	WT/FT LBF/FT	SMEAR RATIO
BHD NO.1							
SEG							
1	8.87	0.73	0.68	20.68	3.92	30.11	0.19
2	10.89	0.75	0.64	23.43	4.01	36.98	0.15
3	10.89	0.75	0.64	23.43	4.01	36.98	0.15
4	12.24	0.76	0.63	24.73	4.08	41.57	0.13
BHD NO.2							
SEG							
1	8.87	0.73	0.68	20.68	3.92	30.11	0.19
2	10.89	0.75	0.64	23.43	4.01	36.98	0.15
3	10.89	0.75	0.64	23.43	4.01	36.98	0.15
4	12.24	0.76	0.63	24.73	4.08	41.57	0.13
BHD NO.3							
SEG							
1	8.19	0.72	0.71	19.52	3.89	27.81	0.21
2	8.87	0.73	0.68	20.68	3.92	30.11	0.19
BHD NO.4							
SEG							
1	8.19	0.72	0.71	19.52	3.89	27.81	0.21
2	8.87	0.73	0.68	20.68	3.92	30.11	0.19
BHD NO.5							
SEG							
1	7.52	0.72	0.74	18.23	3.85	25.52	0.24
2	9.98	1.00	0.82	29.58	5.41	33.90	0.21

STRENGTH AND STRESSES AT DESIGN LOAD

	LOCAL STRESS BEND. KSI	LOCAL STRESS SHEAR KSI	STRENGTH BUCKL. KSI	STRENGTH ULTIMATE KSI	STRENGTH COLUMN KSI
BHD NO. 1					
SEG					
1	19.12	6.41	27.11	31.96	33.17
2	25.05	8.43	37.69	37.42	31.49
3	31.44	10.58	37.69	37.42	31.49
4	37.24	12.55	40.40	40.28	30.49
BHD NO. 2					
SEG					
1	19.12	6.41	27.11	31.96	33.17
2	25.05	8.43	37.69	37.42	31.49
3	31.44	10.58	37.69	37.42	31.49
4	37.24	12.55	40.40	40.28	30.49
BHD NO. 3					
SEG					
1	15.04	5.04	22.40	29.82	33.79
2	21.47	7.20	27.11	31.96	33.17
BHD NO. 4					
SEG					
1	15.04	5.04	22.40	29.82	33.79
2	21.47	7.20	27.11	31.96	33.17
BHD NO. 5					
SEG					
1	33.25	11.14	18.15	27.54	34.43
2	34.51	11.63	21.96	29.61	37.39

FACTOR OF SAFETY AT DESIGN LOAD

	PLATE BUCKLING	STIFFENER SHEAR	STIFFENED PLATE COMP+BEND	STIFFENED PLATE ULTIMATE	STIFFENED PLATE TENSION+BEND.
BHD NO. 1					
SEG					
1	14.58	3.56	1.99	10.13	1.99
2	17.10	2.71	1.52	9.51	1.52
3	13.62	2.16	1.21	7.57	1.21
4	12.81	1.82	1.02	6.93	1.02
BHD NO. 2					
SEG					
1	14.58	3.56	1.99	10.13	1.99
2	17.10	2.71	1.52	9.51	1.52
3	13.62	2.16	1.21	7.57	1.21
4	12.81	1.82	1.02	6.93	1.02
BHD NO. 3					
SEG					
1	14.57	4.52	2.53	11.65	2.53
2	12.98	3.17	1.77	9.02	1.77
BHD NO. 4					
SEG					
1	14.57	4.52	2.53	11.65	2.53
2	12.98	3.17	1.77	9.02	1.77
BHD NO. 5					
SEG					
1	5.03	2.05	1.14	4.67	1.14
2	6.77	1.96	1.10	6.07	1.10

PRINTED REPORT NO. 12 - TRANSVERSE BULKHEADS

TRANS BHD MTRL TYPE-HTS

MODULUS OF ELASTICITY, KSI	29600.0
DENSITY, LBM/FT3	489.02
YIELD STRENGTH, KSI	45.00
MAX PRIMARY STRENGTH, KSI	21.28
ALLOWABLE WORKING STRENGTH, KSI	38.00

HULL LOADS IND-CALC

	MAX	MIN
STIFFENER SPACING, IN	24.00	24.00

SEGMENT GEOMETRY

	--------NODE COORD, FT				--SCND. LOAD, FT--	
SEG	YUPR	ZUPR	YLWR	ZLWR	HEAD1	HEAD2
1	0.00	62.00	0.00	53.00	33.00	
2	0.00	53.00	0.00	44.00	39.94	
3	0.00	44.00	0.00	35.00	46.86	
4	0.00	35.00	0.00	26.00	53.77	
5	0.00	26.00	0.00	17.00	60.69	
6	0.00	17.00	0.00	3.00	69.34	

SEGMENT SCANTLINGS

	----SCANTLINGS OF STIFFENED PLATES----							
	STIFFENERS				CATLG	NO.OF	PLATE	SPACING
SEG	---------INXINXIN/IN---------				NO	STIFF	TK, IN	IN
1 *F	9.660X	3.960X	0.190/	0.210	14	30	0.2188	21.60
2 *F	9.660X	3.960X	0.190/	0.210	14	29	0.2188	21.60
3 *F	11.685X	3.970X	0.200/	0.225	24	28	0.2500	21.60
4 *F	11.685X	3.970X	0.200/	0.225	24	27	0.2500	21.60
5 *F	11.725X	3.990X	0.220/	0.265	28	26	0.2813	21.60
6 *F	15.430X	6.990X	0.295/	0.430	67	26	0.3438	24.00

NOTE: *F STANDS FOR FABRICATED SHAPE

SEGMENT PROPERTIES

	----PROPERTIES OF STIFFENED PLATES----						
	------AREA------		N.A. TO	-----SEC MOD-----			SMEAR
	TOTAL	SHEAR	PLATE	PLATE	FLANGE	WT/FT	RATIO
SEG	IN2	IN2	IN	IN3	IN3	LBF/FT	
1	7.40	1.92	2.45	40.78	13.07	25.12	0.56
2	7.40	1.92	2.45	40.78	13.07	25.12	0.56
3	8.63	2.43	2.98	56.04	18.15	29.31	0.60
4	8.63	2.43	2.98	56.04	18.15	29.31	0.60
5	9.72	2.70	3.04	63.49	20.95	33.00	0.60
6	15.81	4.78	5.45	125.69	63.72	53.69	0.92

	----STRENGTH AND STRESSES AT DESIGN LOAD----				
	--LOCAL STRESS--		--------STRENGTH--------		
	BEND. KSI	SHEAR KSI	BUCKL. KSI	ULTIMATE KSI	COLUMN KSI
SEG					
1	30.55	8.11	21.96	29.61	37.39
2	37.98	9.99	21.96	29.61	37.39
3	32.67	9.35	21.96	29.61	37.39
4	38.00	10.82	21.96	29.61	37.39
5	37.55	11.08	21.96	29.61	37.39
6	37.09	14.15	21.96	29.61	37.39

	FACTOR OF SAFETY AT DESIGN LOAD				
	--PLATE-	-STIFFENER-	STIFFENED PLATE		
	BUCKLING	SHEAR	COMP+BEND	ULTIMATE	TENSION+BEND.
SEG					
1	6.77	2.81	1.24	6.07	1.10
2	6.77	2.28	1.00	6.07	1.10
3	6.77	2.44	1.16	6.07	1.10
4	6.77	2.11	1.00	6.07	1.10
5	6.77	2.06	1.01	6.07	1.10
6	6.77	1.61	1.02	6.07	1.10

PRINTED REPORT NO. 13 - SIDE AND BOTTOM FRAMES

FRAME SPACING, FT 8.00

SEGMENT GEOMETRY

	NODE COORD, FT				SCND. LOAD, FT	
SEG	YUPR	ZUPR	YLWR	ZLWR	HEAD1	HEAD2
SIDE FRAME						
SEG						
1	52.15	62.00	50.51	53.00	13.00	
2	50.51	53.00	48.80	44.00	22.00	
3	48.80	44.00	47.04	35.00	31.00	
4	47.04	35.00	45.27	26.00	40.00	
5	45.27	26.00	43.52	17.00	49.00	
6	43.52	17.00	36.57	3.00	63.00	
BOT FRAME						
SEG						
1	36.57	3.00	31.29	0.96	65.04	
2	31.29	0.96	20.86	0.53	65.47	
3	20.86	0.53	10.43	0.25	65.75	
4	10.43	0.25	0.00	0.00	66.00	

SEGMENT SCANTLINGS

	SCANTLINGS OF STIFFENED PLATES						
	STIFFENERS INXINXIN/IN				CATLG NO	PLATE TK, IN	SPAN FT
SIDE FRAME							
SEG							
1 *F	11.685X	3.970X	0.200/	0.225	24.	0.6875	9.00
2 *F	13.405X	5.000X	0.230/	0.335	40.	0.3438	9.00
3 *F	15.345X	5.500X	0.250/	0.345	51.	0.3750	9.00
4 *F	15.430X	6.990X	0.295/	0.430	67.	0.4375	9.00
5 *F	15.505X	7.000X	0.305/	0.505	71.	0.3438	9.00
6 *R	26.150X	9.990X	0.490/	0.750	109.	0.3125	14.00
BOT FRAME							
SEG							
1	12.223X	12.223X	0.375/	0.375		0.4375	5.71
2	27.053X	21.875X	0.438/	0.438		0.4375	10.46
3	31.324X	21.875X	0.438/	0.438		0.4375	9.36
4	34.495X	21.875X	0.438/	0.438		0.5000	10.43

NOTE: *F STANDS FOR FABRICATED SHAPE
*R STANDS FOR ROLLED SHAPE

SEGMENT PROPERTIES

	PROPERTIES OF STIFFENED PLATES						
	AREA		N.A. TO	SEC MOD			SMEAR
	TOTAL	SHEAR	PLATE	PLATE	FLANGE	WT/FT	RATIO
SEG	IN2	IN2	IN	IN3	IN3	LBF/FT	
SIDE FRAME							
SEG							
1	69.23	2.52	0.71	337.54	20.14	235.11	0.05
2	37.76	3.24	1.34	339.99	35.84	128.25	0.14
3	41.73	4.02	1.62	427.53	48.06	141.72	0.16
4	49.56	4.81	1.91	519.32	68.95	168.31	0.18
5	41.26	4.99	2.44	440.15	77.34	140.14	0.25
6	50.31	13.33	7.50	745.91	283.90	170.85	0.68
BOT FRAME							
SEG							
1	14.52	4.89	6.21	72.78	66.14	49.29	0.68
2	30.98	12.22	13.96	310.68	310.68	105.20	0.68
3	32.84	14.09	16.10	369.46	369.46	111.54	0.68
4	35.60	15.50	17.07	454.00	421.91	120.89	0.68

STRESS AND FACTOR OF SAFETY

	-STRESS, KSI-		------FOS-----	
	BENDING	SHEAR	BENDING	SHEAR
SIDE FRAME				
SEG				
1	34.24	11.96	1.11	1.91
2	33.96	15.74	1.12	1.45
3	35.91	17.89	1.06	1.27
4	32.89	19.28	1.16	1.18
5	37.28	22.76	1.02	1.00
6	37.11	17.03	1.02	1.34
BOT FRAME				
SEG				
1	37.80	19.56	1.01	1.17
2	28.47	14.42	1.33	1.58
3	19.26	11.25	1.97	2.03
4	20.31	11.44	1.87	1.99

PRINTED REPORT NO. 14 - DECK BEAMS

FRAME SPACING, FT 8.00

SEGMENT GEOMETRY

	--------NODE COORD, FT				SCND. LOAD, FT--	
SEG	YIB	ZIB	YOB	ZOB	HEAD1	HEAD2
WET DECK						
SEG						
1	0.00	62.00	10.43	62.00	8.77	
2	10.43	62.00	20.86	62.00	8.77	
3	20.86	62.00	31.29	62.00	8.77	
4	31.29	62.00	41.72	62.00	8.77	
5	41.72	62.00	52.15	62.00	8.98	

DECK NO. 1

SEG					
1	0.00	53.00	10.43	53.00	2.81
2	10.43	53.00	20.86	53.00	2.86
3	20.86	53.00	31.29	53.00	2.86
4	31.29	53.00	41.72	53.00	2.92
5	41.72	53.00	50.51	53.00	3.18

DECK NO. 2

SEG					
1	0.00	44.00	10.43	44.00	2.81
2	10.43	44.00	20.86	44.00	2.86
3	20.86	44.00	31.29	44.00	2.86
4	31.29	44.00	41.72	44.00	2.92
5	41.72	44.00	48.80	44.00	3.18

DECK NO. 3

SEG					
1	0.00	35.00	10.43	35.00	2.81
2	10.43	35.00	20.86	35.00	2.86
3	20.86	35.00	31.29	35.00	2.86
4	31.29	35.00	41.72	35.00	2.92
5	41.72	35.00	47.04	35.00	3.18

DECK NO. 4

SEG					
1	0.00	26.00	10.43	26.00	2.81
2	10.43	26.00	20.86	26.00	2.86
3	20.86	26.00	31.29	26.00	2.86
4	31.29	26.00	45.27	26.00	2.92

DECK NO. 5

SEG					
1	0.00	17.00	10.43	17.00	2.81
2	10.43	17.00	20.86	17.00	2.86
3	20.86	17.00	31.29	17.00	2.86
4	31.29	17.00	43.52	17.00	2.92

SEGMENT SCANTLINGS

	----------------SCANTLINGS OF STIFFENED PLATES----------------						
	STIFFENERS ---------INXINXIN/IN-------------				CATLG NO	PLATE TK, IN	SPAN FT
WET DECK SEG							
1 *F	11.685X	3.970X	0.200/	0.225	24.	0.5625	10.43
2 *F	11.685X	3.970X	0.200/	0.225	24.	0.5625	10.43
3 *F	11.685X	3.970X	0.200/	0.225	24.	0.5625	10.43
4 *F	11.685X	3.970X	0.200/	0.225	24.	0.5625	10.43
5 *F	11.685X	3.970X	0.200/	0.225	24.	0.6875	10.43
DECK NO. 1 SEG							
1 *R	4.730X	3.960X	0.190/	0.210	2.	0.2813	10.43
2 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
3 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
4 *F	5.685X	3.940X	0.170/	0.215	3.	0.3438	10.43
5 *R	4.730X	3.960X	0.190/	0.210	2.	0.5000	8.79
DECK NO. 2 SEG							
1 *R	4.730X	3.960X	0.190/	0.210	2.	0.2813	10.43
2 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
3 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
4 *F	5.685X	3.940X	0.170/	0.215	3.	0.3438	10.43
5 *R	3.745X	3.940X	0.170/	0.205	1.	0.5000	7.08

DECK NO. 3

SEG							
1 *R	4.730X	3.960X	0.190/	0.210	2.	0.2813	10.43
2 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
3 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
4 *F	5.685X	3.940X	0.170/	0.215	3.	0.3438	10.43
5 *R	3.745X	3.940X	0.170/	0.205	1.	0.5000	5.32

DECK NO. 4

SEG							
1 *R	4.730X	3.960X	0.190/	0.210	2.	0.2813	10.43
2 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
3 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
4 *F	9.660X	3.960X	0.190/	0.210	14.	0.3438	13.98

DECK NO. 5

SEG							
1 *R	4.730X	3.960X	0.190/	0.210	2.	0.2813	10.43
2 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
3 *R	4.730X	3.960X	0.190/	0.210	2.	0.3125	10.43
4 *F	7.685X	3.940X	0.170/	0.205	6.	0.3438	12.23

NOTE: *F STANDS FOR FABRICATED SHAPE
*R STANDS FOR ROLLED SHAPE

SEGMENT PROPERTIES

	PROPERTIES OF STIFFENED PLATES						
	AREA		N.A. TO	SEC MOD			SMEAR
	TOTAL	SHEAR	PLATE	PLATE	FLANGE	WT/FT	RATIO
SEG	IN2	IN2	IN	IN3	IN3	LBF/FT	
WET DECK							
SEG							
1	57.23	2.49	0.72	325.03	19.91	194.35	0.06
2	57.23	2.49	0.72	325.03	19.91	194.35	0.06
3	57.23	2.49	0.72	325.03	19.91	194.35	0.06
4	57.23	2.49	0.72	325.03	19.91	194.35	0.06
5	69.23	2.52	0.71	337.54	20.14	235.11	0.05
DECK NO. 1							
SEG							
1	28.73	0.99	0.36	72.95	5.45	97.58	0.06
2	31.73	1.00	0.36	74.81	5.48	107.76	0.06
3	31.73	1.00	0.36	74.81	5.48	107.76	0.06
4	34.81	1.06	0.40	99.08	6.79	118.23	0.05
5	49.73	1.03	0.38	75.02	5.67	168.88	0.04
DECK NO. 2							
SEG							
1	28.73	0.99	0.36	72.95	5.45	97.58	0.06
2	31.73	1.00	0.36	74.81	5.48	107.76	0.06
3	31.73	1.00	0.36	74.81	5.48	107.76	0.06
4	34.81	1.06	0.40	99.08	6.79	118.23	0.05
5	49.44	0.76	0.34	49.25	4.13	167.90	0.03
DECK NO. 3							
SEG							
1	28.73	0.99	0.36	72.95	5.45	97.58	0.06
2	31.73	1.00	0.36	74.81	5.48	107.76	0.06
3	31.73	1.00	0.36	74.81	5.48	107.76	0.06
4	34.81	1.06	0.40	99.08	6.79	118.23	0.05
5	49.44	0.76	0.34	49.14	4.12	167.90	0.03

DECK NO. 4

SEG							
1	28.73	0.99	0.36	72.95	5.45	97.58	0.06
2	31.73	1.00	0.36	74.81	5.48	107.76	0.06
3	31.73	1.00	0.36	74.81	5.48	107.76	0.06
4	35.67	1.94	0.66	202.52	14.03	121.15	0.08

DECK NO. 5

SEG							
1	28.73	0.99	0.36	72.95	5.45	97.58	0.06
2	31.73	1.00	0.36	74.81	5.48	107.76	0.06
3	31.73	1.00	0.36	74.81	5.48	107.76	0.06
4	35.11	1.40	0.50	148.36	9.67	119.25	0.06

STRESS AND FACTOR OF SAFETY

	-STRESS, KSI-		------FOS-----	
	BENDING	SHEAR	BENDING	SHEAR
WET DECK				
SEG				
1	31.42	9.44	1.21	2.42
2	31.42	9.44	1.21	2.42
3	31.42	9.44	1.21	2.42
4	31.42	9.44	1.21	2.42
5	31.78	9.57	1.20	2.38
DECK NO. 1				
SEG				
1	37.27	7.61	1.02	3.00
2	37.73	7.71	1.01	2.96
3	37.73	7.71	1.01	2.96
4	30.88	7.38	1.23	3.09
5	28.85	6.97	1.32	3.27
DECK NO. 2				
SEG				
1	37.27	7.61	1.02	3.00
2	37.73	7.71	1.01	2.96
3	37.73	7.71	1.01	2.96
4	30.88	7.38	1.23	3.09
5	25.87	7.67	1.47	2.97
DECK NO. 3				
SEG				
1	37.27	7.61	1.02	3.00
2	37.73	7.71	1.01	2.96
3	37.73	7.71	1.01	2.96
4	30.88	7.38	1.23	3.09
5	14.64	5.76	2.60	3.96
DECK NO. 4				
SEG				
1	37.27	7.61	1.02	3.00
2	37.73	7.71	1.01	2.96
3	37.73	7.71	1.01	2.96
4	26.87	5.41	1.41	4.21
DECK NO. 5				
SEG				
1	37.27	7.61	1.02	3.00
2	37.73	7.71	1.01	2.96
3	37.73	7.71	1.01	2.96
4	29.71	6.56	1.28	3.47

PRINTED REPORT NO. 15 - LONGITUDINAL BULKHEAD VERTICAL STIFFENERS

NUMBER OF LONG BHD 5

FRAME SPACING, FT 8.00

SEGMENT GEOMETRY

SEG	NODE COORD, FT YUPR	ZUPR	YLWR	ZLWR	SCND. LOAD, FT HEAD1	HEAD2
LBHD NO.1						
SEG						
1	30.00	62.00	30.00	53.00	22.87	
2	30.00	53.00	30.00	44.00	30.75	
3	30.00	44.00	30.00	35.00	38.54	
4	30.00	35.00	30.00	26.00	46.39	
LBHD NO.2						
SEG						
1	30.00	62.00	30.00	53.00	22.87	
2	30.00	53.00	30.00	44.00	30.75	
3	30.00	44.00	30.00	35.00	38.54	
4	30.00	35.00	30.00	26.00	46.39	
LBHD NO.3						
SEG						
1	20.00	62.00	20.00	53.00	17.84	
2	20.00	53.00	20.00	44.00	25.67	
LBHD NO.4						
SEG						
1	20.00	62.00	20.00	53.00	17.84	
2	20.00	53.00	20.00	44.00	25.67	
LBHD NO.5						
SEG						
1	0.00	26.00	0.00	17.00	39.00	
2	0.00	17.00	0.00	3.00	51.17	

SEGMENT SCANTLINGS

SEG	SCANTLINGS OF STIFFENED PLATES — STIFFENERS INXINXIN/IN				CATLG NO	PLATE TK, IN	SPAN FT
LBHD NO.1							
SEG							
1 *F	13.405X	5.000X	0.230/	0.335	40.	0.3438	9.00
2 *F	15.345X	5.500X	0.250/	0.345	51.	0.4375	9.00
3 *F	15.440X	5.530X	0.275/	0.440	60.	0.4375	9.00
4 *F	15.430X	6.990X	0.295/	0.430	67.	0.5000	9.00
LBHD NO.2							
SEG							
1 *F	13.405X	5.000X	0.230/	0.335	40.	0.3438	9.00
2 *F	15.345X	5.500X	0.250/	0.345	51.	0.4375	9.00
3 *F	15.440X	5.530X	0.275/	0.440	60.	0.4375	9.00
4 *F	15.430X	6.990X	0.295/	0.430	67.	0.5000	9.00
LBHD NO.3							
SEG							
1 *F	11.810X	4.010X	0.235/	0.350	35.	0.3125	9.00
2 *F	11.840X	6.490X	0.230/	0.380	45.	0.3438	9.00
LBHD NO.4							
SEG							
1 *F	11.810X	4.010X	0.235/	0.350	35.	0.3125	9.00
2 *F	11.840X	6.490X	0.230/	0.380	45.	0.3438	9.00

LBHD NO.5

SEG							
1 *F	15.430X	6.990X	0.295/	0.430	67.	0.2813	9.00
2 *R	23.310X	9.010X	0.470/	0.770	103.	0.3438	14.00

NOTE: *F STANDS FOR FABRICATED SHAPE
*R STANDS FOR ROLLED SHAPE

SEGMENT PROPERTIES

	-----------------PROPERTIES OF STIFFENED PLATES						
	------AREA------		N.A. TO	-----SEC MOD-----			SMEAR
	TOTAL	SHEAR	PLATE	PLATE	FLANGE	WT/FT	RATIO
SEG	IN2	IN2	IN	IN3	IN3	LBF/FT	
LBHD NO.1							
SEG							
1	37.76	3.24	1.34	339.99	35.84	128.25	0.14
2	47.73	4.03	1.48	479.22	48.35	162.09	0.14
3	48.68	4.49	1.70	503.24	58.71	165.32	0.16
4	55.56	4.83	1.76	573.99	69.33	188.68	0.16
LBHD NO.2							
SEG							
1	37.76	3.24	1.34	339.99	35.84	128.25	0.14
2	47.73	4.03	1.48	479.22	48.35	162.09	0.14
3	48.68	4.49	1.70	503.24	58.71	165.32	0.16
4	55.56	4.83	1.76	573.99	69.33	188.68	0.16
LBHD NO.3							
SEG							
1	34.18	2.93	1.15	268.23	27.18	116.08	0.14
2	38.19	2.89	1.39	317.76	39.65	129.71	0.16
LBHD NO.4							
SEG							
1	34.18	2.93	1.15	268.23	27.18	116.08	0.14
2	38.19	2.89	1.39	317.76	39.65	129.71	0.16
LBHD NO.5							
SEG							
1	34.56	4.76	2.55	361.02	67.70	117.38	0.28
2	50.89	11.48	5.97	714.98	231.25	172.84	0.54

STRESS AND FACTOR OF SAFETY

	-STRESS, KSI-		------FOS-----	
	BENDING	SHEAR	BENDING	SHEAR
LBHD NO.1				
SEG				
1	35.31	16.36	1.08	1.39
2	35.04	17.67	1.08	1.29
3	36.69	19.90	1.04	1.15
4	37.54	22.27	1.01	1.02
LBHD NO.2				
SEG				
1	35.31	16.36	1.08	1.39
2	35.04	17.67	1.08	1.29
3	36.69	19.90	1.04	1.15
4	37.54	22.27	1.01	1.02
LBHD NO.3				
SEG				
1	36.19	14.11	1.05	1.62
2	36.44	20.58	1.04	1.11
LBHD NO.4				
SEG				
1	36.19	14.11	1.05	1.62
2	36.44	20.58	1.04	1.11

LBHD NO.5

SEG				
1	34.24	18.98	1.11	1.20
2	35.47	16.07	1.07	1.42

PRINTED REPORT NO. 1 - APPENDAGE SUMMARY

APPENDAGE DISP, LTON	130.2		
SHELL DISP, LTON	61.0		
SKEG IND	NONE	RUDDER TYPE IND	SPADE
SKEG DISP, LTON	0.0	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.0000	AVG RUDDER CHORD, FT	14.01
SKEG THK, FT	0.00	RUDDER THK, FT	1.56
SKEG PROJECTED AREA, FT2	0.0	RUDDER SPAN, FT	17.04
		RUDDER PROJECTED AREA, FT2	238.6
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	14.2
BILGE KEEL DISP, LTON	22.0		
BILGE KEEL LGTH, FT	218.30	FIN SIZE IND	CALC
		NO FIN PAIRS	0
SHAFT SUPPORT TYPE IND	OPEN STRUT	FWD FIN	
SHAFT SUPPORT DISP, LTON	18.3	CHORD, FT	
SHAFT DISP, LTON	11.7	THK, FT	
		SPAN, FT	
PROP TYPE IND	FP	PROJECTED AREA, FT2	
PROP BLADE DISP, LTON	3.1	DISP, LTON (PER PAIR)	
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	17.55	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	

PRINTED REPORT NO. 2 - APPENDAGE BUOYANCY AND WEIGHT

		----CENTER OF BUOYANCY----		
APPENDAGE	DISP, LTON	X, FT	Y, FT	Z, FT
SHELL	61.0	322.51	0.00	13.72
BILGE KEELS*	22.0	315.00	42.65	12.50
OPEN STRUTS*	18.3	577.16	12.72	7.48
PROPULSION SHAFTS*	11.7	548.15	12.72	6.49
PROP BLADES*	3.1	605.51	12.72	4.67
RUDDERS*	14.2	621.29	12.72	9.59
TOTAL, LTON	130.2			

* TRANSVERSE C.B. PER SIDE IS SHOWN

SWBS114, SHLL APNDG, LTON 39.34 SWBS565, ROLL FINS, LTON 0.00

PRINTED REPORT NO. 1 - RESISTANCE SUMMARY

RESID RESIST IND	H+M	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	OPEN STRUT
ENDUR DISP IND	FULL LOAD	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	NONE	RUDDER TYPE IND	SPADE
FULL LOAD WT, LTON	19668.3	CORR ALW	0.00050
AVG ENDUR DISP, LTON	19668.3	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	1775.1	TRAILSHAFT PWR FAC	1.15
NO RUDDERS	2.		
NO FIN PAIRS	0.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.099
NO PROP SHAFTS	2.	SUSTN SPEED	0.109
PROP DIA, FT	17.55	ENDUR SPEED	0.185

CONDITION	SPEED KT	------------ FRIC	RESID	EFFECTIVE HORSEPOWER, HP APPDG	WIND	MARGIN	------------ TOTAL	DRAG LBF
MAX	30.65	29231.	24796.	8789.	1379.	5134.	69312.	736987.
SUSTN	29.25	25523.	17290.	7546.	1199.	4124.	55669.	620138.
ENDUR	16.00	4406.	699.	1373.	196.	534.	7207.	146786.

PRINTED REPORT NO. 2 - SPEED-POWER MATRIX

RESID RESIST IND H+M
ENDUR DISP IND FULL LOAD

SPEED AND POWER FOR FULL LOAD DISP
===================================

FULL LOAD WT, LTON 19668.3

SPEED KT	------------ FRIC	RESID	EFFECTIVE HORSEPOWER, HP APPDG	WIND	MARGIN	------------ TOTAL	DRAG LBF
2.00	11.	2.	6.	0.	2.	20.	3312.
4.00	79.	16.	35.	3.	11.	143.	11674.
6.00	255.	49.	102.	10.	33.	449.	24383.
8.00	588.	103.	217.	25.	75.	1007.	41022.
10.00	1124.	178.	392.	48.	139.	1881.	61303.
12.00	1909.	279.	636.	83.	232.	3138.	85217.
14.00	2988.	431.	959.	131.	361.	4869.	113331.
16.00	4406.	699.	1373.	196.	534.	7207.	146786.
18.00	6206.	1167.	1890.	279.	763.	10305.	186552.
20.00	8433.	2108.	2532.	383.	1076.	14532.	236772.
22.00	11130.	3969.	3328.	510.	1515.	20450.	302909.
24.00	14340.	5607.	4229.	662.	1987.	26820.	364151.
26.00	18104.	7888.	5283.	842.	2569.	34680.	434658.
28.00	22467.	12506.	6578.	1051.	3407.	46001.	535361.
30.00	27469.	21009.	8190.	1293.	4636.	62582.	679779.
32.00	33153.	34460.	10170.	1570.	6346.	85675.	872457.

PRINTED REPORT NO. 3 - SHIP GEOMETRIC DATA FOR RESISTANCE COMPUTATIONS

RESID RESIST IND	H+M
ENDUR DISP IND	FULL LOAD

	FULL LOAD	AVE ENDUR DISP
BARE HULL DISP, LTON	19538.2	19538.2
APPENDAGE DISP, LTON	130.1	130.1
TOTAL DISP, LTON	19668.3	19668.3
LBP, FT	630.00	630.00
WL LENGTH, FT	630.00	630.00
BEAM AT MAX AREA STA, FT	89.95	89.95
DRAFT AT MAX AREA STA, FT	23.22	23.22
TAYLOR WETTED SURF AREA, FT2	57030.0	57030.0
SHIP WETTED SURF AREA, FT2	57030.0	57030.0
SKEG WETTED SURF AREA, FT2	0.0	0.0
WIND FRONT AREA, FT2	6583.2	6583.2
FROUDE WETTED SURF COEF	7.3507	7.3507
LENGTH-BEAM RATIO	7.0040	7.0040
BEAM-DRAFT RATIO	3.8743	3.8743
PRISMATIC COEF	0.5686	0.5686
MAX SECTION COEF	0.9136	0.9136
DISP-LENGTH RATIO	78.1399	78.1399
LCB-LENGTH RATIO	0.5085	0.5085
HALF ANG ENTRANCE, DEG	10.95	10.95
HALF ANG RUN, DEG	10.44	10.44
TRANSOM BUTTOCK ANG, DEG	3.70	3.70
BOW SECT AREA COEF	0.0000	0.0000
TRANSOM SECT AREA COEF	0.0896	0.0896
TRANSOM BREADTH COEF	0.6931	0.6931
TRANSOM DEPTH COEF	0.1749	0.1749

PRINTED REPORT NO. 4 - APPENDAGE DATA

SKEG IND	NONE
SKEG AREA, FT2	
BILGE KEEL IND	PRESENT
SHAFT SUPPORT TYPE IND	OPEN STRUT
NO STRUTS PER SHAFT	2.

STRUT DIMENSIONS	MAIN	INTMD
STRUT CHORD, FT	3.64	2.44
STRUT THICKNESS, FT	0.73	0.49
BARREL LENGTH, FT	14.04	16.41
BARREL DIA, FT	3.78	3.49

NO PROP SHAFTS	2.
WET SHAFT LGTH (PORT), FT	84.27
WET SHAFT LGTH (STBD), FT	84.27
INTRMDT SHAFT DIA, FT	1.75

PROP TYPE IND	FP
PROP DIA, FT	17.55
SONAR DOME IND	NONE
SONAR DRAG IND	
SONAR SECT AREA, FT2	
NO RUDDERS	2.
RUDDER AREA, FT2	238.6
NO FIN PAIRS	0.
ROLL FIN AREA, FT2	

PRINTED REPORT NO. 1 - PROPELLER SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	
SHAFT SUPPORT TYPE IND	OPEN STRUT	RUDDER TYPE IND	
MAX SPEED, KT	30.65	ENDUR SPEED, KT	16.00
MAX EHP (/SHAFT), HP	34656.	ENDUR EHP (/SHAFT), HP	3604.
MAX SHP (/SHAFT), HP	48931.	ENDUR SHP (/SHAFT), HP	4930.
MAX PROP RPM	170.0	ENDUR PROP RPM	82.8
MAX PROP EFF	0.708	ENDUR PROP EFF	0.731
SUSTN SPEED, KT	29.25	PROP DIA, FT	17.55
SUSTN EHP (/SHAFT), HP	27835.	NO BLADES	5.
SUSTN SHP (/SHAFT), HP	38920.	PITCH RATIO	1.34
SUSTN PROP RPM	159.3	EXPAND AREA RATIO	0.996
SUSTN PROP EFF	0.715	CAVITATION NO	1.24
NO PROP SHAFTS	2.0		
TOTAL PROPELLER WT, LTON	66.10		

PRINTED REPORT NO. 2 - PROPELLER CHARACTERISTICS

PROP ID IND	
NO PROP SHAFTS	2.
PROP DIA, FT	17.55
NO BLADES	5.
PITCH RATIO	1.34
EXPAND AREA RATIO	0.996
THRUST DED COEF	0.000
TAYLOR WAKE FRAC	0.000
HULL EFFICIENCY	1.000
REL ROTATE EFF	1.000

CHARACTERISTICS	MAXIMUM	SUSTAINED	ENDURANCE
	CONDITIONS		
SPEED, KT	30.65	29.25	16.00
RPM	170.0	159.3	82.8
THRUST/SHAFT, LBF	368498.	310073.	73394.
EHP/SHAFT, HP	34656.	27835.	3604.
TORQUE/SHAFT, FT-LBF	1511726.	1283279.	312785.
SHP/SHAFT, HP	48931.	38920.	4930.
ADVANCE COEF (J)	1.040	1.060	1.115
THRUST COEF (KT)	0.243	0.233	0.204
TORQUE COEF (10KQ)	0.569	0.550	0.496
OPEN WATER EFFY	0.708	0.715	0.731
PC	0.708	0.715	0.731

PRINTED REPORT NO. 3 - CAVITATION CHARACTERISTICS

MAX SPEED OF ADV, KT	30.65
MAX THRUST, LBF	368498.
MAX PROP RPM	170.0
PROP DIA, FT	17.55
HUB DEPTH, FT	18.55
STD CAV NO	1.24
LOCAL CAV NO (.7R)	0.23
MEAN THRUST LOADING COEF	0.14
EXPAND AREA RATIO	0.996
MIN EAR REQUIRED	0.996
BACK CAV ALLOWED, PERCENT	10.0

PRINTED REPORT NO. 4 - PROPELLER ARRANGEMENT

PROP DIA, FT	17.55
FULL LOAD DRAFT, FT	23.22
HUB DEPTH FROM DWL, FT	18.55
LONG LOC FROM AP, FT	24.49
HUB POS FROM CL, FT	12.72
TIP CLR FROM BL, FT	-4.11
TIP CLR FROM MAX HB, FT	30.65
TIP CLR FROM HULL BOT, FT	4.24
TOTAL PROPELLER WT, LTON	66.10

PRINTED REPORT NO. 1 - MACHINERY SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	30.65
ELECT PRPLN TYPE IND	ACC-AC	SUSTN SPEED IND	CALC
SHAFT SUPPORT TYPE IND	OPEN STRUT	SUSTN SPEED, KT	29.25
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	16.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	12898.	ENDURANCE, NM	6000.
AVG 24 HR ELECT LOAD, KW	4354.	USABLE FUEL WT, LTON	1775.8
SWBS 200 GROUP WT, LTON	1058.4	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	969.7		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	4	4	2
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	2000. KW	2	2	1
VSCF SS CYCLO	KW	0	0	0

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	GE-LM2500-30		MTU-16V538
ENG TYPE IND	GT		F DIESEL
ENG SIZE IND	GIVEN		GIVEN
NO INSTALLED	4	0	2
ENG PWR AVAIL, HP	26250.	.	3126.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.393		.345
ENG LOAD FRAC	1.000		.893

PRINTED REPORT NO. 2 - MACHINERY EQUIPMENT LIST

NO EACH	ITEM	WEIGHT LTON	LENGTH FT	WIDTH FT	HEIGHT FT
	PROPULSION PLANT				
4	MAIN ENGINE (BARE)	3.1	15.65	5.20	5.20
4	MAIN ENGINE ENCLOSURE MODULE	12.0	26.57	8.70	8.00
0	MAIN ENGINE INTERCOOLER				
0	SEC ENGINE (BARE)				
0	SEC ENGINE ENCLOSURE MODULE				
0	SEC ENGINE INTERCOOLER				
0	RACER STEAM TURBINE				
0	RACER CONDENSER				
0	LTDR GEAR (01)				
0	EPIC REV PINION GEAR (02)				
0	FRANCO TOSI REV GEAR (03)				
0	VSCF COMB/STEP-UP GEAR (04)				
0	RACER REDUCTION GEAR (05)				
0	2 SPD SOLAR EPIC GEAR (06)				
0	OFFSET GEAR (07)				
0	OFFSET COMB (2-1) GEAR (08)				
0	OFFSET COMB (3-2) GEAR (09)				

0	CR EPIC GEAR (10)				
0	Z DRIVE SPIRAL BVL GEAR (11)				
0	PLANETARY REDUCTION GEAR(12)				
0	CR BI-COUPLED EPIC GEAR (13)				
0	STAR EPIC REV GEAR (14)				
0	STAR EPIC REDUCTION GEAR(15)				
0	COMBINING STEP-UP GEAR (16)				
4	PROPULSION GENERATOR	34.2	16.81	8.13	8.13
2	PROPULSION MOTOR	74.4	14.04	14.43	14.98
2	THRUST BEARING	14.2	4.09	5.72	5.72
2	PROPELLER SHAFT				
	ELECTRIC PLANT				
2	SS ENGINE (BARE)	6.6	10.37	5.38	7.56
0	SS ENGINE ENCLOSURE MODULE				
0	SS REDUCTION GEAR (17)				
2	SEPARATE SS GENERATOR	8.4	7.40	3.60	5.10
0	VSCF SS GENERATOR				
0	VSCF SS CYCLOCONVERTER				

PRINTED REPORT NO. 3 - ENGINES

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG TYPE IND	GT		F DIESEL
ENG MODEL IND	GE-LM2500-30		MTU-16V538
ENG SIZE IND	GIVEN		GIVEN
NO INSTALLED	4	0	2
ENG BARE WT, LTON	3.1		6.6
ENG LENGTH, FT	15.65		10.37
ENG WIDTH, FT	5.20		5.38
ENG HEIGHT, FT	5.20		7.56
ENG PWR AVAIL, HP	26250.	.0	3126.3
ENG RPM	3600.0		1800.0
ENG MASS FL, LBM/SEC	135.5		8.3
ENG EXH TEMP, DEGF	1039.0		943.2
ENG SFC EQN IND	EXPNT		DIESEL
ENG SFC, LBM/HP-HR	0.393		.345
MAX SPEED CONDITION			
NO OPERATING	4	0	2
ENG PWR, HP	26250.		6562.4
ENG RPM	3600.0		1800.0
ENG MASS FL, LBM/SEC	135.5		11.0
ENG EXH TEMP, DEGF	1039.0		1357.3
ENG SFC, LBM/HP-HR	.393		.352
SUSTN SPEED CONDITION			
NO OPERATING	4	0	2
ENG PWR, HP	21000.		6562.4
ENG RPM	3373.2		1800.0
ENG MASS FL, LBM/SEC	124.3		11.0
ENG EXH TEMP, DEGF	986.8		1357.3
ENG SFC, LBM/HP-HR	.414		.352

ENDUR SPEED CONDITION

ENG ENDUR RPM IND	CALC		
NO OPERATING	2	0	1
ENG PWR, HP	6026.		6075.4
ENG RPM	2204.3		1800.0
ENG MASS FL, LBM/SEC	76.9		10.7
ENG EXH TEMP, DEGF	839.2		1293.1
ENG SFC, LBM/HP-HR	.628		.352

NOTE - ENGINE OPERATING DATA ARE BASED ON USE OF DFM FUEL.

PRINTED REPORT NO. 4 - GEARS

NO EACH	ITEM	WEIGHT LTON	LENGTH FT	WIDTH FT	HEIGHT FT
	2-STAGE REDUCTION GEARS				
0	LTDR GEAR (01)				
0	CR BI-COUPLED EPIC GEAR (13)				
	1ST STAGE REDUCTION GEARS				
0	OFFSET GEAR (07)				
0	OFFSET COMB (2-1) GEAR (08)				
0	OFFSET COMB (3-2) GEAR (09)				
0	STAR EPIC REDUCTION GEAR(15)				
	2ND STAGE REDUCTION GEARS				
0	CR EPIC GEAR (10)				
0	PLANETARY REDUCTION GEAR(12)				
	SPECIAL GEARS				
0	EPIC REV PINION GEAR (02)				
0	FRANCO TOSI REV GEAR (03)				
0	VSCF COMB/STEP-UP GEAR (04)				
0	RACER REDUCTION GEAR (05)				
0	2 SPD SOLAR EPIC GEAR (06)				
0	Z DRIVE SPIRAL BVL GEAR (11)				
0	STAR EPIC REV GEAR (14)				
0	COMBINING STEP-UP GEAR (16)				
0	SS REDUCTION GEAR (17)				

REDUCTION GEAR DESIGN FACTORS AND DIMENSIONS	1ST STAGE	2ND STAGE	SS
REDUCTION RATIO			
K FACTOR			
FACE WIDTH RATIO			
CASING WT FACTOR			
GEAR FACE WIDTH, FT			
PINION GEAR DIA, FT			
REDUCTION GEAR DIA, FT			
SUN GEAR DIA, FT			
PLANET GEAR DIA, FT			
RING GEAR DIA, FT			
RING GEAR THK, FT			
NO PLANETS			

PRINTED REPORT NO. 5 - ELECTRIC PROPULSION AND VSCF EQUIPMENT

TRANS TYPE IND-ELECT
ELECT PRPLN TYPE IND-ACC-AC
SWITCHGEAR TYPE IND-ADV
TRANS LINE NODE PT IND-CALC
ELECT PRPLN RATING IND-CALC

TRANS LINE NODE PT X, FT	345.19
TRANS LINE NODE PT Y, FT	.00
TRANS LINE NODE PT Z, FT	9.30

MOTORS AND GENERATORS

	PRPLN GENERATOR	PRPLN MOTOR	VSCF GENERATOR
INSTALLED NUMBER	4	2	0
TYPE	AC	AC	
FREQUENCY CONTROL	YES		
DRIVE		DIRECT	
ROTOR COOLING	AIR	AIR	
ROTOR TIP SPEED, FT/MIN	28500.	28500.	
STATOR COOLING	LIQUID	LIQUID	
ARM ELECT LOAD, AMP/IN	2400.	2400.	
POWER RATING, MW	31.07	36.49	
ROTATIONAL SPEED, RPM	3600.	170.	
NUMBER OF POLES	2.	42.	
LENGTH, FT	16.8	14.0	
WIDTH, FT	8.1	14.4	
HEIGHT, FT	8.1	15.0	
WEIGHT, LTON	34.2	74.4	

OTHER ELECTRIC PROPULSION AND VSCF EQUIPMENT

	WEIGHT LTON
CONTROLS	2.0
BRAKING RESISTORS	14.6
EXCITERS	20.2
SWITCHGEAR	2.6
POWER CONVERTERS	18.6
DEIONIZED COOL WATER SYS	20.1
PRPLN TRANS LINE	40.4
RECTIFIERS	.0
HELIUM REFRIGERATION SYS	.0
VSCF CYCLOCONVERTERS	.0

PRINTED REPORT NO. 6 - SHIP SERVICE GENERATORS

SS SYS TYPE IND-SEP
GEN SIZE IND-GIVEN

ELECT LOAD DES MARGIN FAC	0.200
ELECT LOAD SL MARGIN FAC	0.200
ELECT LOAD IMBAL FAC	0.900
MAX MARG ELECT LOAD, KW	12897.5
MAX STANDBY LOAD, KW	6970.3
24 HR AVG ELECT LOAD, KW	4353.7

VSCF SS CYCLOCONVERTERS

CONDITION	NO INSTALL	NO ONLINE	REQ KW/CYCLO	AVAIL KW/CYCLO	LOADING FRAC
WINTER BATTLE	0	0			0.000
WINTER CRUISE	0	0			0.000
SUMMER CRUISE	0	0			0.000
ENDURANCE(24 HR AVG)	0	0			0.000

SEPARATE SS GENERATORS

CONDITION	NO INSTALL	NO ONLINE	REQ KW/GEN	AVAIL KW/GEN	LOADING FRAC
WINTER BATTLE	2	2	4703.	2000.	2.351
WINTER CRUISE	2	1	12898.	2000.	6.449
SUMMER CRUISE	2	1	8090.	2000.	4.045
ENDURANCE(24 HR AVG)	2	1	4354.	2000.	2.177

TOTALS

CONDITION	REQ KW	AVAIL KW	LOADING FRAC
WINTER BATTLE	9405.	4000.	2.351
WINTER CRUISE	12898.	2000.	6.449
SUMMER CRUISE	8090.	2000.	4.045
ENDURANCE(24 HR AVG)	4354.	2000.	2.177

PRINTED REPORT NO. 7 - INTAKE DUCTS

INLET TYPE IND-PLENUM
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-84 DBA

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	GT		F DIESEL
INLET DUCT XSECT AREA,FT2	99.6	.0	.0
INLET DUCT XSECT LTH, FT	11.45	.0	.0
INLET DUCT XSECT WID, FT	8.70	.0	.0

MMR1

	MAIN ENG WT,LTON	MAIN ENG VCG,FT	SEC ENG WT,LTON	SEC ENG VCG,FT
INLET	0.8	98.00		
INLET DUCTING	2.7	73.15		
INLET SILENCER	2.8	68.24		
GT COOLING SUPPLY	2.7	63.13		
GT BLEED AIR SUPPLY	3.9	56.34		

MMR2

	MAIN ENG WT,LTON	MAIN ENG VCG,FT	SEC ENG WT,LTON	SEC ENG VCG,FT
INLET	0.8	88.00		
INLET DUCTING	3.7	52.65		
INLET SILENCER	2.8	37.24		
GT COOLING SUPPLY	3.7	39.90		
GT BLEED AIR SUPPLY	3.9	30.80		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

ENGINE CATEGORY	AREA,FT2 HULL	AREA,FT2 DKHS	VOLUME,FT3 HULL	VOLUME,FT3 DKHS
MAIN ENGINES	1195.5	1673.7	10760.	16737.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	0.0	0.0	0.	0.
TOTALS	1195.5	1673.7	10760.	16737.

PRINTED REPORT NO. 8 - EXHAUST DUCTS

EXHAUST IR SUPPRESS IND-PRESENT
DUCT SILENCING IND-BOTH
GT ENG ENCL IND-84 DBA

EXHAUST STACK TEMP, DEGF	350.0
EDUCTOR DESIGN FAC	1.000

	MAIN ENG	SEC ENG	SS ENG
ENG TYPE	GT		F DIESEL
ENG EXH TEMP, DEG	1039.		905.
ENG MASS FL, LBM/SEC	135.5		7.9
EXH DUCT GAS TEMP, DEG	927.		905.
EXH DUCT GAS DEN, LBM/FT3	0.0282		.0286
EXH DUCT MASS FL, LBM/SEC	154.5		7.9
EXH DUCT AREA, FT2	51.0		2.6

MMR1

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	11.4	73.15		
EXH SILENCER	11.2	76.57		
EXH STACK	3.0	108.30		
EXH SPRAY RING	1.3	81.64		
EXH EDUCTOR	13.7	111.81		

MMR2

	----MAIN ENG-----		-----SEC ENG-----	
	WT,LTON	VCG,FT	WT,LTON	VCG,FT
EXH DUCT (TO BOILER/REG)				
EXH BOILER (RACER)				
EXH REGENERATOR				
EXH DUCT (TO STACK)	15.6	52.65		
EXH SILENCER	11.2	45.57		
EXH STACK	3.0	98.30		
EXH SPRAY RING	1.3	64.71		
EXH EDUCTOR	13.7	101.81		

NOTE - NUMERIC DATA PRESENTED ABOVE ARE ON A PER ENGINE BASIS.

TRUNK AREA AND VOLUME REQUIREMENTS

	-----AREA,FT2----		---VOLUME,FT3----	
ENGINE CATEGORY	HULL	DKHS	HULL	DKHS
MAIN ENGINES	1580.2	2212.3	14222.	22123.
SECONDARY ENGINES	0.0	0.0	0.	0.
SHIP-SERVICE ENGINES	106.4	53.2	958.	532.
TOTALS	1686.6	2265.5	15180.	22655.

PRINTED REPORT NO. 9 - PROPELLERS AND SHAFTS

SHAFT SUPPORT TYPE IND-OPEN STRUT
SHAFT SYS SIZE IND-CALC
PROP TYPE IND-FP

PROP DIA, FT	17.55
HUB DIA, FT	3.78
PROP BLADE WT, LTON	11.9
PROP HUB WT, LTON	21.1
BEND STRESS CON FAC	1.000
OVRHG PROP MOM ARM RATIO	0.340
EQUIV FP PROP WT, LTON	33.0
ALLOW BEND STRESS, LBF/IN2	6000.
FATIGUE LIMIT, LBF/IN2	47500.
YIELD POINT, LBF/IN2	75000.
TORQUE MARGIN FAC	1.200
OFF-CENTER THRUST FAC	1.000
NO STRUTS PER SHAFT	2

PORT SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	2.27	2.27	2.27
LENGTH, FT	14.91	122.55	12.52
DIAMETER, FT	2.26	1.75	1.53
BORE RATIO	.550	.667	.667
WEIGHT, LTON	12.2	47.7	3.2
LCG, FT	594.90	526.22	458.74
TCG, FT	-12.72	-12.72	-12.72
VCG, FT	5.09	7.80	10.47
FACTOR OF SAFETY		2.00	1.75

STBD SHAFT

	PROP SECTION	INTERMED SECTION	LINE SECTION
ANGLE, DEG	2.27	2.27	2.27
LENGTH, FT	14.91	122.55	12.52
DIAMETER, FT	2.26	1.75	1.53
BORE RATIO	.550	.667	.667
WEIGHT, LTON	12.2	47.7	3.2
LCG, FT	594.90	526.22	458.74
TCG, FT	12.72	12.72	12.72
VCG, FT	5.09	7.80	10.47
FACTOR OF SAFETY		2.00	1.75

PRINTED REPORT NO. 10 - STRUTS, PODS, AND RUDDERS

SHAFT SUPPORT TYPE IND-OPEN STRUT
SHAFT SYS SIZE IND-CALC

PROP DIA, FT	17.55
NO STRUTS PER SHAFT	2
NO SHAFTS	2
OVRHG PROP MOM ARM RATIO	0.340

STRUTS

	MAIN STRUT	INTERMED STRUT
WALL THICKNESS, FT	.27	.18
CHORD, FT	3.64	2.44
THICKNESS, FT	.73	.49
BARREL LTH, FT	14.04	16.41
BARREL DIA, FT	3.78	3.49

PODS

STRUT WALL THICKNESS, FT
STRUT CHORD, FT
STRUT THICKNESS, FT
BARREL LTH, FT
BARREL DIA, FT

RUDDERS

RUDDER TYPE IND-SPADE
RUDDER SIZE IND-CALC

NO RUDDERS	2.
RUDDER WT (PER), LTON	48.0
RUDDER DISP (PER), LTON	7.1

	CHORD, FT	THICK, FT	SPAN, FT
SPADE RUDDER	14.01	1.56	17.04

PRINTED REPORT NO. 11 - ELECTRIC LOADS

400 HZ ELECT LOAD FAC 0.200

PAYLOAD LOADS	WINTER CRUISE KW	WINTER BATTLE KW	SUMMER CRUISE KW
COMMAND AND SURVEILLANCE (60 HZ)	0.0	0.0	0.0
COMMAND AND SURVEILLANCE (400 HZ)	0.0	0.0	0.0
ARMAMENT (60 HZ)	0.0	0.0	0.0
ARMAMENT (400 HZ)	0.0	0.0	0.0
OTHER PAYLOAD (60 HZ)	0.0	0.0	0.0
OTHER PAYLOAD (400 HZ)	0.0	0.0	0.0
SUB-TOTAL	0.0	0.0	0.0

NON-PAYLOAD LOADS (* INDICATES USER ADJUSTED VALUE)

PROPULSION AND STEERING	574.8	666.7	373.6
LIGHTING	717.0	702.6	717.0
MISCELLANEOUS ELECTRIC	46.1	40.1	46.1
HEATING	4078.7	2080.1	203.9
VENTILATION	1563.1	1203.6	1563.1
AIR CONDITIONING	1429.3	1343.5	2133.2
AUXILIARY BOILER AND FRESH WATER	0.0	0.0	0.0
FIREMAIN	349.2	492.4	349.2
UNREP AND HANDLING	53.8	12.9	53.8
MISC AUXILIARY MACHINERY	92.8	52.0	92.8
SERVICES AND WORK SPACES	147.7	48.7	147.7
SUBTOTAL	9052.4	6642.7	5680.5
TOTAL	9052.4	6642.7	5680.5
TOTAL (INCLUDING MARGINS)	12897.5	9405.5	8090.2

MAX MARG ELECT LOAD	12897.5
24 HR AVG ELECT LOAD	4353.7
CONNECTED ELECT LOAD	23988.9
ANCHOR ELECT LOAD	6970.3
VITAL ELECT LOAD	4158.1
EMERGENCY ELECT LOAD	3713.2
MAX STBY ELECT LOAD	6970.3

PRINTED REPORT NO. 12 - POWERING

SUSTN SPEED IND-CALC
ENDUR SPEED IND-GIVEN
TRANS EFF IND-CALC

100 PCT POWER TRANS EFF	0.9320
25 PCT POWER TRANS EFF	0.9000

	MAX SPEED	SUSTN SPEED	ENDUR SPEED
SHIP SPEED, KT	30.65	29.25	16.00
PROP RPM	170.0	159.3	82.8
NO OP PROP SHAFTS	2	2	2
EHP (/SHAFT), HP	34655.	27834.	3604.
PROPULSIVE COEF	0.708	0.715	0.731
ENDUR PWR ALW	1.0	1.0	1.1
SHP (/SHAFT), HP	48930.	38919.	5423.
TRANS EFFY	0.932	0.927	0.900
CP PROP TRANS EFFY MULT	1.000	1.000	1.000
PROPUL PWR (/SHAFT), HP	52500.	42000.	6026.
PD GEN PWR (/SHAFT), HP	0.	0.	0.
BHP (/SHAFT), HP	52500.	42000.	6026.

PRINTED REPORT NO. 13 - HULL STRUCTURE AND MISCELLANEOUS WEIGHT

SWBS	COMPONENT	WT,LTON	LCG,FT	VCG,FT
160	SPECIAL STRUCTURES			
161	CASTINGS, FORGINGS, AND WELDMENTS	106.7	360.71	19.36
162	STACKS AND MASTS	12.1	258.59	103.30
180	FOUNDATIONS			
182	PROPULSION PLANT FOUNDATIONS	286.0	342.26	12.54
183	ELECTRIC PLANT FOUNDATIONS	27.4	245.13	28.29

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 14 - PROPULSION WEIGHT

MACHINERY SWBS	COMPONENT	WT,LTON	LCG,FT	VCG,FT
200	PROPULSION PLANT	1058.4	366.77	26.68
210	ENERGY GENERATING SYSTEM (NUCLEAR)	0.0	0.00	0.00
220	ENERGY GENERATING SYSTEM (NON-NUCLEAR)	0.0	0.00	0.00
230	PROPULSION UNITS	502.2	340.48	17.99
233	PROPULSION INTERNAL COMBUSTION ENGINES	0.0	0.00	0.00
234	PROPULSION GAS TURBINES	100.1	248.23	24.80
235	ELECTRIC PROPULSION	402.1	363.43	16.29
240	TRANSMISSION AND PROPULSOR SYSTEMS	244.1	547.44	6.96
241	PROPULSION REDUCTION GEARS	0.0	0.00	0.00
242	PROPULSION CLUTCHES AND COUPLINGS	0.0	0.00	0.00
243	PROPULSION SHAFTING	126.1	536.14	7.41
244	PROPULSION SHAFT BEARINGS	51.9	500.94	8.80
245	PROPULSORS	66.1	605.51	4.67
250	PRPLN SUPPORT SYS (EXCEPT FUEL+LUBE OIL)	247.9	259.46	66.73
251	COMBUSTION AIR SYSTEM	55.9	245.91	53.87
252	PROPULSION CONTROL SYSTEM	28.9	248.23	40.30
256	CIRCULATING AND COOLING SEA WATER SYSTEM	4.4	396.90	22.32
259	UPTAKES (INNER CASING)	158.8	262.49	77.29
260	PRPLN SUPPORT SYS (FUEL+LUBE OIL)	33.2	238.49	14.75
261	FUEL SERVICE SYSTEM	9.4	216.73	18.80
262	MAIN PROPULSION LUBE OIL SYSTEM	17.0	248.23	12.00
264	LUBE OIL FILL, TRANSFER, AND PURIF	6.8	244.23	16.00
290	SPECIAL PURPOSE SYSTEMS	31.1	365.23	15.14
298	OPERATING FLUIDS	20.6	378.00	8.00
299	REPAIR PARTS AND SPECIAL TOOLS	10.5	340.20	29.14

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 15 - ELECTRIC PLANT WEIGHT

SWBS	COMPONENT	WT,LTON	LCG,FT	VCG,FT
300	ELECTRIC PLANT	969.7	316.93	30.16
310	ELECTRIC POWER GENERATION	136.0	228.51	17.00
311	SHIP SERVICE POWER GENERATION	40.4	228.51	27.90
313	BATTERIES AND SERVICE FACILITIES	95.6	228.51	12.40
314	POWER CONVERSION EQUIPMENT	0.0	0.00	0.00
320	POWER DISTRIBUTION SYSTEMS	713.6	335.47	29.43
321	SHIP SERVICE POWER CABLE	624.8	333.90	27.00
324	SWITCHGEAR AND PANELS	88.8	346.50	46.50
330	LIGHTING SYSTEM	83.5	330.21	56.53
331	LIGHTING DISTRIBUTION	34.6	333.90	55.80
332	LIGHTING FIXTURES	48.9	327.60	57.04
340	POWER GENERATION SUPPORT SYSTEMS	28.6	241.85	35.24
342	DIESEL SUPPORT SYSTEMS	28.6	241.85	35.24
343	TURBINE SUPPORT SYSTEMS	0.0	0.00	0.00
390	SPECIAL PURPOSE SYSTEMS	8.1	295.81	26.17
398	OPERATING FLUIDS	6.1	228.51	27.90
399	REPAIR PARTS AND SPECIAL TOOLS	2.0	497.70	21.00

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 16 - MACHINERY ROOMS

NO MAIN MACHINERY ROOMS	2
NO AUX MACHINERY ROOMS	3
NO OTHER MACHINERY ROOMS	1

BULKHEAD LOCATIONS

MR NO	MR ID	FWD BHD BHD NO	FWD BHD X, FT	FWD BHD X/LBP	AFT BHD BHD NO	AFT BHD X, FT	AFT BHD X/LBP
1	OMR1	2.	74.23	0.118	3.	116.96	0.186
2	MMR1	4.	159.68	0.253	5.	213.72	0.339
3	MMR2	7.	308.22	0.489	8.	362.25	0.575
4	AMR1	8.	362.25	0.575	9.	409.50	0.650
5	AMR2	9.	409.50	0.650	10.	453.60	0.720
6	AMR3	9.	409.50	0.650	10.	453.60	0.720

DIMENSIONS

MR NO	MR ID	LENGTH, FT AVAIL	LENGTH, FT REQ	WIDTH, FT AVAIL	WIDTH, FT REQ	HEIGHT, FT AVAIL	HEIGHT, FT REQ
1	OMR1	42.73	26.06	77.62	6.38	62.00	53.14
2	MMR1	54.03	46.38	92.52	20.90	53.00	45.37
3	MMR2	54.03	46.38	91.07	20.90	26.00	14.37
4	AMR1	47.25	26.06	90.74	6.38	26.00	12.22
5	AMR2	44.10	20.52	89.90	40.88	26.00	19.92
6	AMR3	44.10	20.52	89.90	40.88	26.00	19.92

ARRANGEMENTS

MR NO	MR ID	ROTATION ANGLE, DEG
1	OMR1	0.00
2	MMR1	0.00
3	MMR2	0.00
4	AMR1	0.00
5	AMR2	0.00
6	AMR3	0.00

PRINTED REPORT NO. 17 - MACHINERY ARRANGEMENTS

CLEARANCES (MACHINERY TO MACHINERY)

ENG TO ENG CLR, FT	1.00
ENG TO GEAR CLR, FT OR ENG TO GEN CLR OR GEAR TO GEN CLR	1.00
MTR TO GEAR CLR, FT	2.50
PRPLN ARR TO SS ARR CLR, FT	6.00
AISLE WIDTH CLR, FT	2.50
PORT/CL TB TO GEAR CLR, FT	.00
STBD TB TO GEAR CLR, FT	.00

SEPARATIONS (BETWEEN HULL AND MACHINERY)

LONG (TO BHD), FT	1.00
TRANS (TO SIDE SHELL), FT	1.00
VERT (TO HULL BOT), FT	1.00
RADIAL (TO POD), FT	1.00

ARRANGEMENTS

ARRANGEMENT	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	4	4	2
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SHIP SERVICE ARR	DIESEL	2	2	1

MACHINERY COMPONENT LOCATIONS

COMPONENT	MR ID	CG LOC, FT X	Y	Z
MAIN ENG	MMR1	173.97	-5.60	40.30
MAIN ENG	MMR1	173.97	5.60	40.30
MAIN ENG	MMR2	322.50	-5.60	9.30
MAIN ENG	MMR2	322.50	5.60	9.30
SS ENG	OMR1	80.41	0.00	48.36
SS ENG	AMR1	368.44	0.00	7.44
PRPLN MTR	AMR2	441.39	-12.72	11.16
PRPLN MTR	AMR2	441.39	12.72	11.16

SHAFTING

SHAFT TYPE	END POINT LOC, FT X	Y	Z	SHAFT ANGLE, DEG
PORT SHAFT	452.49	-12.72	10.72	2.27
STBD SHAFT	452.49	12.72	10.72	2.27

PRINTED REPORT NO. 18 - MACHINERY SPACE REQUIREMENTS

MACHINERY ROOM VOLUME REQUIREMENTS

VOLUME CATEGORY	VOLUME, FT3
SWBS GROUP 200	202572.
PROPULSION POWER GENERATION	77043.
PROPULSION ENGINES	51442.
PROPULSION REDUCTION GEARS AND GENERATORS	25601.
DRIVELINE MACHINERY	15073.
REDUCTION AND BEVEL GEARS WITH Z-DRIVE	0.
ELECTRIC PROPULSION MOTORS AND GEARS	15073.
REMOTELY-LOCATED THRUST BEARINGS	0.
PROPELLER SHAFT	4591.
ELECTRIC PROPULSION MISCELLANEOUS EQUIPMENT	23362.
CONTROLS	2895.
BRAKING RESISTORS	2871.
MOTOR AND GENERATOR EXCITERS	5164.
SWITCHGEAR	2567.
POWER CONVERTERS	4623.
DEIONIZED COOLING WATER SYSTEMS	5241.
RECTIFIERS	0.
HELIUM REFRIGERATION SYSTEMS	0.
PROPULSION AUXILIARIES	82502.
PROPULSION LOCAL CONTROL CONSOLES	5056.
CP PROP HYDRAULIC OIL POWER MODULES	0.
FUEL OIL PUMPS	46625.
LUBE OIL PUMPS	4892.
LUBE OIL PURIFIERS	21438.
ENGINE LUBE OIL CONDITIONERS	1683.
SEAWATER COOLING PUMPS	2808.
SWBS GROUP 300	25252.
ELECTRIC PLANT POWER GENERATION	4315.
ELECTRIC PLANT ENGINES	2329.
ELECTRIC PLANT GENERATORS AND GEARS	1986.
SHIP SERVICE SWITCHBOARDS	20937.
CYCLOCONVERTERS	0.

SWBS GROUP 500	90575.
AUXILIARY MACHINERY	90575.
AIR CONDITIONING PLANTS	10416.
AUXILIARY BOILERS	17250.
FIRE PUMPS	6980.
DISTILLING PLANTS	29224.
AIR COMPRESSORS	21896.
ROLL FIN PAIRS	0.
SEWAGE PLANTS	4810.

ARRANGEABLE AREA REQUIREMENTS

SSCS	GROUP NAME	FT2 HULL/DKHS	FT2 DKHS ONLY
4.31	AUXILIARY MACHINERY DELTA	-9605.2	0.0
4.3311	SHIP SERVICE POWER GENERATION	1463.9	0.0
4.132	INTERNAL COMB ENG COMB AIR	0.0	0.0
4.133	INTERNAL COMB ENG EXHAUST	106.4	53.2
4.142	GAS TURBINE ENG COMB AIR	1195.5	1673.7
4.143	GAS TURBINE ENG EXHAUST	1580.2	2212.3

NOTE: * DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 19 - SURFACE SHIP ENDURANCE CALCULATION FORM

DESIGN MODE IND-ENDURANCE
ENDUR DISP IND-FULL LOAD
ENDUR DEF IND-USN
SHIP FUEL TYPE IND-DFM

ENG ENDUR RPM IND-CALC

SHIP FUEL LHV, BTU/LBM 18360.
DFM FUEL LHV, BTU/LBM 18360.

(1)	ENDURANCE REQUIRED, NM	6000.
(2)	ENDURANCE SPEED, KT	16.00
(3)	FULL LOAD DISPLACEMENT, LTON	19668.3
(3A)	AVERAGE ENDURANCE DISPLACEMENT, LTON	19668.3
(4)	RATED FULL POWER SHP, HP	97860.
(5)	DESIGN ENDURANCE POWER SHP @ (2)&(3A), HP	9861.
(6)	AVERAGE ENDURANCE POWER (SHP), HP (5) X 1.10	10847.
(7)	RATIO, AVG END SHP/RATED F.P. SHP (6)/(4)	0.11084
(8)	AVERAGE ENDURANCE BHP, HP (8A)+(8B)	12052.
(8A)	AVERAGE PRPLN ENDURANCE BHP, HP (6)/TRANSMISSION EFFICIENCY	12052.
(8B)	SHIP SERV PWR SUPPLIED BY PRPLN ENG, HP	0.
(9)	24 HOUR AVERAGE ELECTRIC LOAD, KW	4354.
(9A)	24 HOUR AVERAGE ELECTRIC LOAD PORTION SUPPLIED BY SS ENG, KW	4354.

(10)	CALCULATED PROPULSION FUEL RATE @(8), LBM/HP-HR	0.628
(11)	CALC PRPLN FUEL CONSUMPTION, LBM/HR (10)X(8)	7572.5
(12)	CALC SS GEN FUEL RATE @ (9A), LBM/KW-HR	0.492
(13)	CALC SS GEN FUEL CONSUMPTION, LBM/HR (12)X(9A)	2141.1
(14)	CALC FUEL CONSUMPTION FOR OTHER SERVICES, LBM/HR	0.0
(15)	TOTAL CALC ALL-PURPOSE FUEL CONSUMPTION, LBM/HR (11)+(13)+14)	9713.7
(16)	CALC ALL-PURPOSE FUEL RATE, LBM/HP-HR (15)/(6)	0.896
(17)	FUEL RATE CORRECTION FACTOR BASED ON (7)	1.0400
(18)	SPECIFIED FUEL RATE, LBM/HP-HR (16)X(17)	0.931
(19)	AVG ENDURANCE FUEL RATE, LBM/HP-HR (18)X1.05	0.978
(20)	ENDURANCE FUEL (BURNABLE), LTON (1)X(6)X(19)/(2)X2240	1775.8
(21)	TAILPIPE ALLOWANCE FACTOR	0.95
(22)	ENDURANCE FUEL LOAD, LTON (20)/(21)	1869.2

PRINTED REPORT NO. 20 - MACHINERY MARGINS

PROPULSION PLANT

MAIN ENG MAX LOAD FRAC	1.000
SEC ENG MAX LOAD FRAC	
TORQUE MARGIN FAC	1.200

ELECTRIC PLANT

SS ENG MAX LOAD FRAC	0.893
ELECT LOAD DES MARGIN FAC	0.200
ELECT LOAD SL MARGIN FAC	0.200
ELECT LOAD IMBAL FAC	0.900

PRINTED REPORT NO. 1 - WEIGHT SUMMARY

SWBS	GROUP		WEIGHT LTON	WEIGHT PER CENT	LCG FT		VCG FT
100	HULL STRUCTURE		6764.7	34.4	308.52		43.44
200	PROPULSION PLANT		1058.4	5.4	366.77		26.68
300	ELECTRIC PLANT		973.7	4.9	316.79		30.23
400	COMMAND + SURVEILLANCE		169.8	0.9	271.04		63.37
500	AUXILIARY SYSTEMS		1008.8	5.1	330.81		40.96
600	OUTFIT + FURNISHINGS		1142.0	5.8	270.00		58.11
700	ARMAMENT		1134.0	5.8	392.44		44.05
	LIGHT SHIP		12251.4	62.3	319.70		42.44
M21	PD MARGIN	(WT = 2.4%)	+ 294.0			(KG = 2.4%)	+ 1.02
M22	CD MARGIN	(WT = 2.4%)	+ 301.1			(KG = 2.4%)	+ 1.04
M11	D & B MARGIN	(WT = 5.3%)	+ 680.9			(KG = 5.3%)	+ 2.36
M23	CON MOD MARGIN	(WT = 1.4%)	+ 179.9			(KG = 1.4%)	+ .62
M24	GFM MARGIN	(WT = .6%)	+ 77.1			(KG = .6%)	+ .27
	LIGHT SHIP WITH MARGINS		13784.3	70.1	319.70		47.75
F00	FULL LOADS		5887.7	29.9	343.22		21.75
F10	SHIPS FORCE + EFFECTS		46.2		175.22		91.86
F20	MISSION RELATED EXPENDABLES		391.5		233.45		11.26
F30	SHIPS STORES		60.5		128.52		50.41
F40	FUELS + LUBRICANTS		3548.7		334.91		11.43
F50	LIQUIDS + GASES (NON FUEL)		77.5		194.67		16.31
F60	CARGO		1763.3		402.62		42.27
	FULL LOAD WT		19672.0	100.0	326.74		39.97

PRINTED REPORT NO. 2 - HULL STRUCTURES WEIGHT

SWBS	COMPONENT	WT-LTON	VCG-FT	LCG-FT
100	HULL STRUCTURES	6764.7	43.44	308.52
110	SHELL + SUPPORTS	1616.6	28.42	293.82
111	PLATING	1024.9	35.61	337.87
113	INNER BOTTOM	167.0	3.00	3.00
114	SHELL APPENDAGES	39.3	12.50	315.00
115	STANCHIONS	18.3	31.00	315.00
116	LONGIT FRAMING	101.9	.94	252.00
117	TRANSV FRAMING	265.1	29.36	318.22
120	HULL STRUCTURAL BULKHDS	818.3	35.06	257.39
121	LONGIT STRUCTURAL BULKHDS	265.7	40.85	229.38
122	TRANSV STRUCTURAL BULKHDS	433.7	32.28	336.26
123	TRUNKS + ENCLOSURES	118.9	32.28	32.28
124	BULKHEADS, TORPEDO PROTECT SYS			
130	HULL DECKS	718.7	61.96	337.88
131	MAIN DECK	718.7	61.96	337.88
132	2ND DECK			
133	3RD DECK			
134	4TH DECK			
135	5TH DECK+DECKS BELOW			
136	01 HULL DECK			
137	02 HULL DECK			
138	03 HULL DECK			
139	04 HULL DECK			
140	HULL PLATFORMS/FLATS	1698.1	37.74	373.60
141	1ST PLATFORM	458.5	52.93	359.05
142	2ND PLATFORM	369.3	43.94	383.08
143	3RD PLATFORM	344.4	34.93	387.88
144	4TH PLATFORM	298.9	25.95	390.26
145	5TH PLAT+PLATS BELOW	117.0	17.05	336.73
149	FLATS	109.9	16.39	351.59
150	DECK HOUSE STRUCTURE	897.9	86.32	214.88
151	1ST DECKHOUSE LEVEL	120.5	71.31	216.13
152	2ND DECKHOUSE LEVEL	222.4	76.67	219.86
153	3RD DECKHOUSE LEVEL	202.2	86.22	216.05
154	4TH DECKHOUSE LEVEL	187.2	93.84	216.05
155	5TH DECKHOUSE LEVEL	165.6	101.84	204.55
156	6TH DECKHOUSE LEVEL			
157	7TH DECKHOUSE LEVEL			
158	8TH DECKHOUSE LEVEL			
159	9TH DECKHOUSE LEVEL			
160	SPECIAL STRUCTURES	353.7	36.38	342.26
161	CASTINGS+FORGINGS+EQUIV WELDMT	106.7	19.36	360.71
162	STACKS AND MACKS	12.1	103.30	258.59
163	SEA CHESTS	2.2	.53	298.74
164	BALLISTIC PLATING			
165	SONAR DOMES			
166	SPONSONS			
167	HULL STRUCTURAL CLOSURES	68.7	41.95	304.34
168	DKHS STRUCTURAL CLOSURES	13.7	81.15	205.65
169	SPECIAL PURPOSE CLOSURES+STRUCT	150.4	36.98	366.28
170	MASTS+KINGPOSTS+SERV PLATFORM	19.4	120.40	233.98
171	MASTS,TOWERS,TETRAPODS	19.4	120.40	233.98
172	KINGPOSTS AND SUPPORT FRAMES			
179	SERVICE PLATFORMS			
180	FOUNDATIONS	429.1	26.15	320.98

181 HULL STRUCTURE FOUNDATIONS				
182 PROPULSION PLANT FOUNDATIONS	286.0	12.54	342.26
183 ELECTRIC PLANT FOUNDATIONS	27.4	28.29	245.13
184 COMMAND+SURVEILLANCE FDNS	7.6	80.86	207.51
185 AUXILIARY SYSTEMS FOUNDATIONS	74.2	40.40	334.52
186 OUTFIT+FURNISHINGS FOUNDATIONS	8.9	67.99	224.70
187 ARMAMENT FOUNDATIONS	24.9	105.95	188.84
190 SPECIAL PURPOSE SYSTEMS	212.9	31.33	319.20
191 BALLAST+BOUYANCY UNITS			
196 MILL TOLERANCE			
197 WELDING AND RIVETS	97.3	35.48	312.03
198 FREE FLOODING LIQUIDS	25.6	3.88	373.01
199 HULL REPAIR PARTS+SPECIAL TOOLS	90.0	34.66	311.63

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 3 - PROPULSION PLANT WEIGHT

SWBS COMPONENT	WT-LTON	VCG-FT	LCG-FT
200 PROPULSION PLANT	1058.4	26.68	366.77
210 ENERGY GEN SYS (NUCLEAR)			
220 ENERGY GENERATING SYSTEM (NONNUC)			
221 PROPULSION BOILERS			
222 GAS GENERATORS			
223 MAIN PROPULSION BATTERIES			
224 MAIN PROPULSION FUEL CELLS			
230 PROPULSION UNITS	502.2	17.99	340.48
231 STEAM TURBINES			
232 STEAM ENGINES			
233 DIESEL ENGINES			
234 GAS TURBINES	100.1	24.80	248.23
235 ELECTRIC PROPULSION	402.1	16.29	363.43
236 SELF-CONTAINED PROPULSION SYS			
237 AUXILIARY PROPULSION DEVICES			
240 TRANSMISSION+PROPULSOR SYSTEMS	244.1	6.96	547.44
241 REDUCTION GEARS			
242 CLUTCHES + COUPLINGS			
243 SHAFTING	126.1	7.41	536.14
244 SHAFT BEARINGS	51.9	8.80	500.94
245 PROPULSORS	66.1	4.67	605.51
246 PROPULSOR SHROUDS AND DUCTS			
247 WATER JET PROPULSORS			
250 SUPPORT SYSTEMS	247.9	66.73	259.46
251 COMBUSTION AIR SYSTEM	55.9	53.87	245.91
252 PROPULSION CONTROL SYSTEM	28.9	40.30	248.23
253 MAIN STEAM PIPING SYSTEM			
254 CONDENSERS AND AIR EJECTORS			
255 FEED AND CONDENSATE SYSTEM			
256 CIRC + COOL SEA WATER SYSTEM	4.4	22.32	396.90
258 H.P. STEAM DRAIN SYSTEM			
259 UPTAKES (INNER CASING)	158.8	77.29	262.49
260 PROPUL SUP SYS- FUEL, LUBE OIL	33.2	14.75	238.49
261 FUEL SERVICE SYSTEM	9.4	18.80	216.73
262 MAIN PROPULSION LUBE OIL SYSTEM	17.0	12.00	248.23
264 LUBE OIL HANDLING	6.8	16.00	244.23

290 SPECIAL PURPOSE SYSTEMS	31.1	15.14	365.23
298 OPERATING FLUIDS	20.6	8.00	378.00
299 REPAIR PARTS + TOOLS	10.5	29.14	340.20

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 4 - ELECTRIC PLANT WEIGHT

SWBS COMPONENT	WT-LTON	VCG-FT	LCG-FT
300 ELECTRIC PLANT, GENERAL	973.7	30.23	316.79
310 ELECTRIC POWER GENERATION	136.0	17.00	228.51
311 SHIP SERVICE POWER GENERATION	40.4	27.90	228.51
312 EMERGENCY GENERATORS			
313 BATTERIES+SERVICE FACILITIES	95.6	12.40	228.51
314 POWER CONVERSION EQUIPMENT			
320 POWER DISTRIBUTION SYS	717.6	29.52	335.18
321 SHIP SERVICE POWER CABLE	624.8	27.00	333.90
322 EMERGENCY POWER CABLE SYS			
323 CASUALTY POWER CABLE SYS	4.0	47.26	283.73
324 SWITCHGEAR+PANELS	88.8	46.50	346.50
330 LIGHTING SYSTEM	83.5	56.53	330.21
331 LIGHTING DISTRIBUTION	34.6	55.80	333.90
332 LIGHTING FIXTURES	48.9	57.04	327.60
340 POWER GENERATION SUPPORT SYS	28.6	35.24	241.85
341 SSTG LUBE OIL			
342 DIESEL SUPPORT SYS	28.6	35.24	241.85
343 TURBINE SUPPORT SYS			
390 SPECIAL PURPOSE SYS	8.1	26.17	295.81
398 ELECTRIC PLANT OP FLUIDS	6.1	27.90	228.51
399 REPAIR PARTS+SPECIAL TOOLS	2.0	21.00	497.70

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 5 - COMMAND+SURVEILLANCE WEIGHT

SWBS COMPONENT	WT-LTON	VCG-FT	LCG-FT
400 COMMAND+SURVEILLANCE	169.8	63.37	271.04
410 COMMAND+CONTROL SYS	2.3	66.62	143.50
411 DATA DISPLAY GROUP	.4	108.48	127.21
412 DATA PROCESSING GROUP	1.9	56.98	147.26
413 DIGITAL DATA SWITCHBOARDS			
414 INTERFACE EQUIPMENT			
415 DIGITAL DATA COMMUNICATIONS			
417 COMMAND+CONTROL ANALOG SWBD			
420 NAVIGATION SYS	6.8	81.56	324.97
421 NON-ELECT NAVIGATION AIDS	.0	95.44	126.56
422 ELECTRICAL NAVIGATION AIDS	3.3	81.18	446.34
423 ELECTRONIC NAVIG AIDS, RADIO	.6	116.83	141.24
424 ELECTRONIC NAVIG AIDS, ACOUSTIC	.2	78.81	129.43
426 ELECTRICAL NAVIGATION SYS	2.7	74.29	232.96
427 INERTIAL NAVIGATION SYS			

430 INTERIOR COMMUNICATIONS	59.3	54.53	265.30
431 SWITCHBOARDS FOR I.C. SYSTEMS	1.2	82.31	277.38
432 TELEPHONE SYSTEMS	12.7	64.80	240.41
433 ANNOUNCING SYSTEMS	10.2	63.13	264.71
434 ENTERTAINMENT + TRAINING SYS	4.0	94.08	174.49
435 VOICE TUBES+MESSAGE PASSING SYS	1.2	111.63	117.07
436 ALARM, SAFETY, WARNING SYSTEMS	7.9	52.06	264.13
437 INDICATING, ORDER, METERING SYS	18.5	31.22	322.44
438 INTEGRATED CONTROL SYSTEMS	3.5	46.50	209.40
440 EXTERIOR COMMUNICATIONS	20.8	99.11	167.81
441 RADIO SYSTEMS	12.8	99.27	172.26
442 UNDERWATER SYSTEMS			
443 VISUAL + AUDIBLE SYSTEMS	.8	115.88	123.93
444 TELEMETRY SYSTEMS			
445 TTY + FACSIMILE SYSTEMS	1.7	95.45	162.18
446 SECURITY EQUIPMENT SYSTEMS	5.4	97.36	165.72
450 SURF SURV SYS (RADAR)	11.6	96.88	209.16
451 SURFACE SEARCH RADAR	3.3	97.93	210.98
452 AIR SEARCH RADAR (2D)	7.3	97.03	207.78
453 AIR SEARCH RADAR (3D)			
454 AIRCRAFT CONTROL APPROACH RADAR			
455 IDENTIFICATION SYSTEMS (IFF)	1.0	92.26	213.15
456 MULTIPLE MODE RADAR			
459 SPACE VEHICLE ELECTRONIC TRACKG			
460 UNDERWATER SURVEILLANCE SYSTEMS			
461 ACTIVE SONAR			
462 PASSIVE SONAR			
463 MULTIPLE MODE SONAR			
464 CLASSIFICATION SONAR			
465 BATHYTHERMOGRAPH			
466 MISC ELECTRONICS			
470 COUNTERMEASURES	60.4	46.04	329.23
471 ACTIVE + ACTIVE/PASSIVE ECM			
472 PASSIVE ECM	1.8	97.86	214.38
473 TORPEDO DECOYS	2.9	52.64	566.44
474 DECOYS (OTHER)			
475 DEGAUSSING	55.7	44.00	320.67
476 MINE COUNTERMEASURES			
480 FIRE CONTROL SYS	3.2	91.90	188.62
481 GUN FIRE CONTROL SYSTEMS	3.2	91.90	188.62
482 MISSILE FIRE CONTROL SYSTEMS			
483 UNDERWATER FIRE CONTROL SYSTEMS			
484 INTEGRATED FIRE CONTROL SYSTEMS			
489 WEAPON SYSTEM SWITCHBOARDS			
490 SPECIAL PURPOSE SYS	5.4	103.98	248.74
491 ELCTRNC TEST,CHKOUT,MONITR EQPT	.0	98.18	141.21
492 FLIGHT CNTRL+INSTR LANDING SYS			
493 NON-COMBAT DATA PROCESSING SYS			
494 METEOROLOGICAL SYSTEMS			
495 SPEC PURPOSE INTELLIGENCE SYS			
496 OPERATION SPACE ITEMS			
498 C+S OPERATING FLUIDS	.4	95.62	266.32
499 REPAIR PARTS+SPECIAL TOOLS	4.9	104.73	247.41

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 6 - AUXILIARY SYSTEMS WEIGHT

	SWBS	COMPONENT	WT-LTON	VCG-FT	LCG-FT
	500	AUXILIARY SYSTEMS, GENERAL	1008.8	40.96	330.81
	510	CLIMATE CONTROL	160.4	60.45	258.68
	511	COMPARTMENT HEATING SYSTEM	9.1	76.67	217.23
	512	VENTILATION SYSTEM	43.3	63.90	253.35
	513	MACHINERY SPACE VENT SYSTEM	25.8	51.77	332.83
	514	AIR CONDITIONING SYSTEM	56.0	65.40	218.02
	516	REFRIGERATION SYSTEM	1.9	92.49	104.65
	517	AUX BOILERS+OTHER HEAT SOURCES	24.4	43.65	310.37
	520	SEA WATER SYSTEMS	231.1	34.40	305.51
	521	FIREMAIN+SEA WATER FLUSHING SYS	76.5	47.70	280.57
	522	SPRINKLING SYSTEM	1.5	57.38	193.06
	523	WASHDOWN SYSTEM	3.5	69.93	452.75
	524	AUXILIARY SEAWATER SYSTEM	48.4	16.23	278.95
	526	SCUPPERS+DECK DRAINS	1.7	71.08	345.54
	527	FIREMAIN ACTUATED SERV, OTHER			
	528	PLUMBING DRAINAGE	18.7	60.37	213.50
	529	DRAINAGE+BALLASTING SYSTEM	80.7	23.95	361.40
	530	FRESH WATER SYSTEMS	60.8	32.58	284.76
	531	DISTILLING PLANT	11.6	45.03	292.41
	532	COOLING WATER	1.7	107.00	159.12
	533	POTABLE WATER	13.1	60.78	225.66
*	534	AUX STEAM + DRAINS IN MACH BOX			
*	535	AUX STEAM + DRAINS OUT MACH BOX			
	536	AUXILIARY FRESH WATER COOLING	34.4	14.04	310.80
	540	FUELS/LUBRICANTS,HANDLING+STORAGE	106.9	45.27	329.92
	541	SHIP FUEL+COMPENSATING SYSTEM	106.9	45.27	329.92
	542	AVIATION+GENERAL PURPOSE FUELS			
	543	AVIATION+GENERAL PURPOSE LUBO			
	544	LIQUID CARGO			
	545	TANK HEATING			
	549	SPEC FUEL+LUBRICANTS HANDL+STOW			
	550	AIR,GAS+MISC FLUID SYSTEM	182.0	42.86	318.87
	551	COMPRESSED AIR SYSTEMS	105.1	42.74	314.39
	552	COMPRESSED GASES	1.1	45.40	409.59
	553	O2 N2 SYSTEM			
	554	LP BLOW			
	555	FIRE EXTINGUISHING SYSTEMS	75.4	43.01	322.73
	556	HYDRAULIC FLUID SYSTEM			
	557	LIQUID GASES, CARGO			
	558	SPECIAL PIPING SYSTEMS	.4	36.60	500.83
	560	SHIP CNTL SYS	104.7	20.50	602.26
	561	STEERING+DIVING CNTL SYS	39.3	23.11	596.76
	562	RUDDER	65.4	18.93	605.56
	565	TRIM+HEEL SYSTEMS			
	568	MANEUVERING SYSTEMS			
	570	UNDERWAY REPLENISHMENT SYSTEMS	37.1	63.07	245.43
	571	REPLENISHMENT-AT-SEA SYSTEMS	11.2	63.04	290.27
	572	SHIP STORES+EQUIP HANDLING SYS	14.8	56.85	121.47
*	573	CARGO HANDLING SYSTEMS	10.0	72.00	360.00
	574	VERTICAL REPLENISHMENT SYSTEMS	1.2	65.47	395.38
	575	VEHICAL HANDLING+STOWAGE SYSTEMS			
*	580	MECHANICAL HANDLING SYSTEMS	10.0	72.00	360.00
	581	ANCHOR HANDLING+STOWAGE SYSTEMS			
	582	MOORING+TOWING SYSTEMS			
	583	BOATS,HANDLING+STOWAGE SYSTEMS			

584	MECH OPER DOOR,GATE,RAMP,TTBL SYS			
585	ELEVATING + RETRACTING GEAR			
586	AIRCRAFT RECOVERY SUPPORT SYS			
588	AIRCRAFT HANDLING,SERVICE,STOWAGE			
589	MISC MECH HANDLING SYSTEMS			
590	SPECIAL PURPOSE SYSTEMS	115.9	33.21	304.43
591	SCIENTIFIC+OCEAN ENGINEERING SYS			
592	SWIMMER+DIVER SUPPORT+PROT SYS			
593	ENVIRONMENTAL POLLUTION CNTL SYS	16.1	23.18	315.78
594	SUBMARINE RESC+SALVG+SURVIVE SYS			
595	TOW,LAUNCH,HANDLE UNDERWATER SYS			
596	HANDLING SYS FOR DIVER+SUBMR VEH			
597	SALVAGE SUPPORT SYSTEMS			
598	AUX SYSTEMS OPERATING FLUIDS	84.9	35.56	300.92
599	AUX SYSTEMS REPAIR PARTS+TOOLS	14.9	30.65	312.14

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 7 - OUTFIT+FURNISHINGS WEIGHT

SWBS	COMPONENT	WT-LTON	VCG-FT	LCG-FT
600	OUTFIT+FURNISHING,GENERAL	1142.0	58.11	270.00
610	SHIP FITTINGS	141.1	43.21	401.81
611	HULL FITTINGS	122.4	39.36	390.61
612	RAILS,STANCHIONS+LIFELINES	16.8	67.08	498.45
613	RIGGING+CANVAS	2.0	78.55	276.19
620	HULL COMPARTMENTATION	245.3	67.95	260.04
621	NON-STRUCTURAL BULKHEADS	97.4	80.03	195.47
622	FLOOR PLATES+GRATING	99.7	61.45	316.15
623	LADDERS	25.9	40.02	334.85
624	NON-STRUCTURAL CLOSURES	17.5	74.43	197.36
625	AIRPORTS,FIXED PORTLTS, WINDOWS	4.8	84.55	229.98
630	PRESERVATIVES+COVERINGS	483.2	51.45	275.64
631	PAINTING	128.3	37.67	311.90
632	ZINC COATING			
633	CATHODIC PROTECTION	29.3	12.78	371.81
634	DECK COVERINGS	198.2	54.20	275.10
635	HULL INSULATION	96.3	66.69	230.37
636	HULL DAMPING			
637	SHEATHING	25.3	87.51	193.51
638	REFRIGERATION SPACES	5.8	47.35	116.09
639	RADIATION SHIELDING			
640	LIVING SPACES	65.0	89.92	167.89
641	OFFICER BERTHING+MESSING	12.4	88.48	169.62
642	NON-COMM OFFICER B+M	4.2	103.04	170.08
643	ENLISTED PERSONNEL B+M	41.0	88.53	166.40
644	SANITARY SPACES+FIXTURES	4.8	92.55	173.88
645	LEISURE+COMMUNITY SPACES	2.6	92.76	168.58
650	SERVICE SPACES	24.9	75.27	243.77
651	COMMISSARY SPACES	12.0	84.48	177.93
652	MEDICAL SPACES	4.5	68.61	239.89
653	DENTAL SPACES	1.7	74.52	199.15
654	UTILITY SPACES	3.3	79.25	236.63
655	LAUNDRY SPACES	3.2	45.33	533.07
656	TRASH DISPOSAL SPACES	.2	89.48	167.18

660 WORKING SPACES	103.5	65.76	222.08
661 OFFICES	8.4	61.11	138.24
662 MACH CNTL CENTER FURNISHING	.4	58.27	248.82
663 ELECT CNTL CENTER FURNISHING	4.3	225.55	91.09
664 DAMAGE CNTL STATIONS	9.9	43.40	261.35
665 WORKSHOPS,LABS,TEST AREAS	80.6	60.42	232.89
670 STOWAGE SPACES	67.5	53.70	175.59
671 LOCKERS+SPECIAL STOWAGE	19.4	63.24	281.53
672 STOREROOMS+ISSUE ROOMS	48.1	49.86	132.92
673 CARGO STOWAGE			
690 SPECIAL PURPOSE SYSTEMS	11.4	51.26	51.26
698 OPERATING FLUIDS	3.9	61.13	211.51
699 REPAIR PARTS+SPECIAL TOOLS	7.5	46.18	264.84

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 8 - ARMAMENT WEIGHT

SWBS COMPONENT	WT-LTON	VCG-FT	LCG-FT
700 ARMAMENT	1134.0	44.05	392.44
710 GUNS+AMMUNITION	22.5	145.40	208.58
711 GUNS	11.8	205.10	182.49
712 AMMUNITION HANDLING	1.9	88.72	210.60
713 AMMUNITION STOWAGE	8.8	77.34	243.32
720 MISSLES+ROCKETS	2.2	97.32	150.25
721 LAUNCHING DEVICES	1.1	97.04	148.69
722 MISSILE+ROCKET,GUID CAP HAND SYS			
723 MISSILE+ROCKET STOWAGE	1.1	97.61	151.85
724 MISSILE HYDRAULICS			
725 MISSILE GAS			
726 MISSILE COMPENSATING			
727 MISSILE LAUNCHER CONTROL			
728 MISSILE HEAT,COOL,TEMP CNTRL			
729 MISSILE MONITOR,TEST,ALINEMENT			
730 MINES			
731 MINE LAUNCHING DEVICES			
732 MINE HANDLING			
733 MINE STOWAGE			
740 DEPTH CHARGES			
741 DEPTH CHARGE LAUNCHING DEVICES			
742 DEPTH CHARGE HANDLING			
743 DEPTH CHARGE STOWAGE			
750 TORPEDOES			
751 TORPEDO TUBES			
752 TORPEDO HANDLING			
753 TORPEDO STOWAGE			
760 SMALL ARMS+PYROTECHNICS	9.1	65.91	244.54
761 SMALL ARMS+PYRO LAUNCHING DEV	.4	51.33	487.39
762 SMALL ARMS+PYRO HANDLING			
763 SMALL ARMS+PYRO STOWAGE	8.6	66.66	232.15
770 CARGO MUNITIONS	16.1	38.92	123.52
772 CARGO MUNITIONS HANDLING	6.7	46.34	121.58
773 CARGO MUNITIONS STOWAGE	9.4	33.66	124.89

	780 AIRCRAFT RELATED WEAPONS			
	782 AIRCRAFT RELATED WEAPONS HANDL			
	783 AIRCRAFT RELATED WEAPONS STOW			
	790 SPECIAL PURPOSE SYSTEMS	1084.3	41.74	401.95
*	791 SPECIAL WEAPONS SYSTEMS	1058.0	40.29	406.96
	792 SPECIAL WEAPONS HANDLING			
	793 SPECIAL WEAPONS STOWAGE			
	797 MISC ORDINANCE SPACES			
	798 ARMAMENT OPERATING FLUIDS	2.0	87.74	163.80
	799 ARMAMENT REPAIR PART+TOOLS	24.3	101.28	203.33

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 9 - LOADS WEIGHT (FULL LOAD CONDITION)

	SWBS	COMPONENT	WT-LTON	VCG-FT	LCG-FT
	F00	LOADS	5887.7	21.75	343.22
	F10	SHIPS FORCE	46.2	91.86	175.22
	F11	OFFICERS	6.8	89.68	145.74
	F12	NON-COMMISSIONED OFFICERS	2.8	104.18	179.22
	F13	ENLISTED MEN	26.3	96.40	199.91
	F15	TROOPS	10.3	78.35	130.50
	F20	MISSION RELATED EXPENDABLES+SYS	391.5	11.26	233.45
*	F21	SHIP AMMUNITION	391.5	11.26	233.45
	F22	ORD DEL SYS AMMO			
	F23	ORD DEL SYS (AIRCRAFT)			
	F24	ORD REPAIR PARTS (SHIP)			
	F25	ORD REPAIR PARTS (ORD)			
	F26	ORD DEL SYS SUPPORT EQUIP			
	F29	SPECIAL MISSION RELATED SYS			
	F30	STORES	60.5	50.41	128.52
	F31	PROVISIONS+PERSONNEL STORES	51.8	51.16	128.26
	F32	GENERAL STORES	8.7	45.95	130.05
	F39	SPECIAL STORES			
	F40	LIQUIDS, PETROLEUM BASED	3548.7	11.43	334.91
*	F41	DIESEL FUEL MARINE	3040.1	12.60	341.59
*	F42	JP-5	500.0	4.50	300.00
	F43	GASOLINE			
	F44	DISTILLATE FUEL			
	F45	NAVY STANDARD FUEL OIL (NSFO)			
	F46	LUBRICATING OIL	8.5		
	F49	SPECIAL FUELS AND LUBRICANTS			
	F50	LIQUIDS, NON-PETRO BASED	77.5	16.31	194.67
	F51	SEA WATER			
	F52	FRESH WATER	60.7	11.53	182.48
	F53	RESERVE FEED WATER	6.9	17.31	310.21
	F54	HYDRAULIC FLUID	3.2	48.30	210.02
	F55	SANITARY TANK LIQUID	6.6	43.54	177.83
	F56	GAS (NON FUEL TYPE)			
	F59	MISC LIQUIDS, NON-PETROLEUM			

F60 CARGO	1763.3	42.27	402.62
F61 CARGO, ORDINANCE + DELVRY SYS	54.7	38.54	127.18
F62 CARGO, STORES			
F63 CARGO, FUELS + LUBRICANTS	117.9	17.54	364.24
F64 CARGO, LIQUIDS, NON-PETROLEUM			
F65 CARGO, CRYOGENIC+LIQUEFIED GAS			
F66 CARGO, AMPHIBIOUS ASSAULT SYS	1590.8	44.23	414.93
F67 CARGO, GASES			
F69 CARGO, MISCELLANEOUS			

* DENOTES INCLUSION OF PAYLOAD OR ADJUSTMENTS

PRINTED REPORT NO. 10 - WEIGHT AND KG MODIFICATION SUMMARY

ROW	WT KEY	P+A NAME	WT - LTON ORIGINAL	WT - LTON CHANGE	WT - LTON RESULT.	VCG - FT ORIG.	VCG - FT CHANGE	VCG - FT RESULT.	LCG -FT ORIG.	LCG -FT CHANGE	LCG -FT RESULT.
19	W534	AUX STEAM	0.0	0.0	0.0	UNKNOW	0.0	0.0	UNKNOW	0.0	0.0
20	W535	AUX STEAM	0.0	0.0	0.0	UNKNOW	0.0	0.0	UNKNOW	0.0	0.0
16	W573	CRANES	0.0	10.0	10.0	UNKNOW	72.0	72.0	UNKNOW	360.0	360.0
17	W580	CRANES	0.0	10.0	10.0	UNKNOW	72.0	72.0	UNKNOW	360.0	360.0
1	W791	WOLF EEL (2)	0.0	80.0		UNKNOW	50.0		UNKNOW	235.0	
2		WELL DECK PTX'S (2)		260.0			32.0			330.0	
3		WELL DECK PTX'S (2)		260.0			32.0			450.0	
4		WELL DECK PTX'S (2)		260.0			32.0			560.0	
5		FLIGHT DECK PTX'S (2 CH-53E)		66.0			69.0			250.0	
6		FLIGHT DECK PTX'S (2 CH-53E)		66.0			69.0			300.0	
7		FLIGHT DECK PTX'S (2 CH-53E)									

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                66.0   1058.0              69.0    40.3              410.0
407.0
  18    WF21    AMMO
     20.5    371.0     391.5      70.2      8.0    11.3      205.4   235.0
233.4
  12    WF41    DFM FOR PTX'S
   2580.1    115.0                11.6      4.5              188.6   240.0

  13            DFM FOR PTX'S
             115.0                          4.5                      280.0

  14            DFM FOR PTX'S
             115.0                          4.5                      320.0

  15            DFM FOR PTX'S
             115.0   3040.1                 4.5    12.6              360.0
341.6
   8    WF42    JP-5 FUEL
      0.0    125.0              UNKNOW      4.5             UNKNOW   240.0

   9            JP-5 FUEL
             125.0                          4.5                      280.0

  10            JP-5 FUEL
             125.0                          4.5                      320.0

  11            JP-5 FUEL
             125.0    500.0                 4.5     4.5              360.0
300.0
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PRINTED REPORT NO. 11 - P+A WEIGHTS AND VCGS

ROW / WT KEY	PAYLOAD NAME / WEIGHT ADD,LTON	WEIGHT FAC	VCG KEY	VCG ADD,FT	VCG FAC	LCG KEY	LCG ADD,FT	LCG FAC
19 W534	AUX STEAM 0.00	0.00	BL	0.00	1.00	FPRP	0.00	1.00
20 W535	AUX STEAM 0.00	0.00	BL	0.00	1.00	FPRP	0.00	1.00
16 W573	CRANES 10.00	0.00	BL	72.00	0.00	FPRP	360.00	0.00
17 W580	CRANES 10.00	0.00	BL	72.00	0.00	FPRP	360.00	0.00
1 W791	WOLF EEL (2) 80.00	0.00	BL	50.00	0.00	FPRP	235.00	0.00

2	WELL DECK PTX'S (2)							
W791	260.00	0.00	BL	32.00	0.00	FPRP	330.00	0.00
3	WELL DECK PTX'S (2)							
W791	260.00	0.00	BL	32.00	0.00	FPRP	450.00	0.00
4	WELL DECK PTX'S (2)							
W791	260.00	0.00	BL	32.00	0.00	FPRP	560.00	0.00
5	FLIGHT DECK PTX'S (2 CH-53E)							
W791	66.00	0.00	BL	69.00	0.00	FPRP	250.00	0.00
6	FLIGHT DECK PTX'S (2 CH-53E)							
W791	66.00	0.00	BL	69.00	0.00	FPRP	300.00	0.00
7	FLIGHT DECK PTX'S (2 CH-53E)							
W791	66.00	0.00	BL	69.00	0.00	FPRP	410.00	0.00
18	AMMO							
WF21	371.00	0.00	BL	8.00	0.00	FPRP	235.00	0.00
12	DFM FOR PTX'S							
WF41	115.00	0.00	BL	4.50	0.00	FPRP	240.00	0.00
13	DFM FOR PTX'S							
WF41	115.00	0.00	BL	4.50	0.00	FPRP	280.00	0.00
14	DFM FOR PTX'S							
WF41	115.00	0.00	BL	4.50	0.00	FPRP	320.00	0.00
15	DFM FOR PTX'S							
WF41	115.00	0.00	BL	4.50	0.00	FPRP	360.00	0.00
8	JP-5 FUEL							
WF42	125.00	0.00	BL	4.50	0.00	FPRP	240.00	0.00
9	JP-5 FUEL							
WF42	125.00	0.00	BL	4.50	0.00	FPRP	280.00	0.00
10	JP-5 FUEL							
WF42	125.00	0.00	BL	4.50	0.00	FPRP	320.00	0.00
11	JP-5 FUEL							
WF42	125.00	0.00	BL	4.50	0.00	FPRP	360.00	0.00

PRINTED REPORT NO. 1 - SPACE MODULE SUMMARY

COLL PROTECT SYSTEM-PRESENT		HAB STANDARD-NAVY	
SONAR DOME-NONE		UNIT COMMANDER-FLAG	
FULL LOAD WT, LTON	19672.0	HAB STANDARD FAC	0.000
TOTAL CREW ACC	422.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	14.85	AC MARGIN FAC	0.200
MR VOLUME, FT3	460993.	SPACE MARGIN FAC	0.050

		AREA FT2		VOL FT3
	PAYLOAD REQUIRED	TOTAL REQUIRED	TOTAL AVAILABLE	TOTAL ACTUAL
DKHS ONLY	0.0	21008.2	80230.2	802302.
HULL OR DKHS	0.0	161374.6	142336.0	2689995.
TOTAL	0.0	182382.8	222566.2	3492297.

SSCS GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
1. MISSION SUPPORT	80195.2	1338.4	44.0
2. HUMAN SUPPORT	23007.6	1662.0	12.6
3. SHIP SUPPORT	58718.1	8311.3	32.2
4. SHIP MOBILITY SYSTEM	11777.0	8696.2	6.5
5. UNASSIGNED	8684.9	1000.4	4.8
TOTAL	182382.8	21008.2	100.0

PRINTED REPORT NO. 2 - MISSION SUPPORT AREA

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2
1.	MISSION SUPPORT	80195.2	1338.4
1.1	COMMAND, COMMUNICATION+SURV	3663.2	1232.0
1.11	EXTERIOR COMMUNICATIONS		
1.111	RADIO		
1.112	UNDERWATER SYSTEMS		
1.12	SURVEILLANCE SYS		
1.121	SURFACE SURV (RADAR)		
1.122	UNDERWATER SURV (SONAR)		
1.13	COMMAND+CONTROL	1232.0	1232.0
1.131	COMBAT INFO CENTER		
1.132	CONNING STATIONS	1232.0	1232.0
1.1321	PILOT HOUSE	1152.0	1152.0
1.1322	CHART ROOM	80.0	80.0
1.14	COUNTERMEASURES		
1.141	ELECTRONIC		
1.142	TORPEDO		
1.143	MISSILE		
1.15	INTERIOR COMMUNICATIONS	2409.7	
1.16	ENVIRONMENTAL CNTL SUP SYS	21.6	

1.2	WEAPONS		
1.21	GUNS		
1.22	MISSILES		
1.23	ROCKETS		
1.24	TORPEDOS		
1.25	DEPTH CHARGES		
1.26	MINES		
1.27	MULT EJECT RACK STOW		
1.28	WEAP MODULE STA & SERV INTER		
1.3	AVIATION		
1.31	AVIATION LAUNCH+RECOVERY		
1.311	LAUNCHING+RECOVERY AREAS		
1.312	LAUNCHING+RECOVERY EQUIP		
1.32	AVIATION CONTROL		
1.321	FLIGHT CONTROL		
1.322	NAVIGATION		
1.323	OPERATIONS		
1.33	AVIATION HANDLING		
1.34	AIRCRAFT STOWAGE		
1.35	AVIATION ADMINISTRATION		
1.36	AVIATION MAINTENANCE		
1.37	AVIATION ORDINANCE		
1.372	CONTROL		
1.373	HANDLING		
1.374	STOWAGE		
1.38	AVIATION FUEL SYS		
1.39	AVIATION STORES		
1.4	AMPHIBIOUS		
1.5	CARGO		
1.6	INTERMEDIATE MAINT FAC	75898.8	
1.64	STOWAGE	75898.8	
1.641	WEAPONS	75898.8	
1.7	FLAG FACILITIES	40.0	40.0
1.73	HANDLING		
1.74	STOWAGE	40.0	40.0
1.8	SPECIAL MISSIONS		
1.9	SM ARMS,PYRO+SALU BAT	593.1	66.4
1.91	SM ARMS (LOCKER)	289.9	
1.92	PYROTECHNICS (LOCKER)	66.4	66.4
1.93	SALUTING BAT (MAGAZINE)	97.8	
1.95	SECURITY FORCE EQUIP	139.1	

PRINTED REPORT NO. 3 - HUMAN SUPPORT AREA

HAB STD = NAVY

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2
2.	HUMAN SUPPORT	23007.6	1662.0
2.1	LIVING	14742.4	1602.4
2.11	OFFICER LIVING	5002.4	1602.4
2.111	BERTHING	4627.4	1477.4
2.1111	SHIP OFFICER	4068.7	918.7
2.1115	FLAG OFFICER	558.7	558.7
2.112	SANITARY	375.0	125.0
2.1121	SHIP OFFICER	330.0	80.0
2.1125	FLAG OFFICER	45.0	45.0
2.12	CPO LIVING	1158.4	
2.121	BERTHING	946.4	
2.122	SANITARY	212.0	
2.13	CREW LIVING	8336.5	
2.131	BERTHING	7020.0	
2.132	SANITARY	1158.3	
2.133	RECREATION	158.3	
2.1332	LIBRARY	158.3	
2.14	GENERAL SANITARY FACILITIES	110.0	
2.141	LADIES RETIRING ROOM	80.0	
2.142	BRIDGE WASHROOM+WC	15.0	
2.143	DECK WASHROOM+WC	15.0	
2.15	SHIP RECREATION FAC	135.0	
2.152	MOTION PIC FILM+EQUIP	84.4	
2.153	PHYSICAL FITNESS	50.6	
2.154	TV ROOM		
2.16	TRAINING		
2.2	COMMISSARY	6068.7	
2.21	FOOD SERVICE	3239.0	
2.211	OFFICER (MESS+LOUNGE)	961.5	
2.212	CPO (MESS+LOUNGE)	589.2	
2.213	CREW (MESS+LOUNGE)	1688.2	
2.22	COMMISSARY SERVICE SPACES	1708.6	
2.23	FOOD STORAGE+ISSUE	1121.1	
2.231	CHILL PROVISIONS	324.2	
2.232	FROZEN PROVISIONS	115.2	
2.233	DRY PROVISIONS	472.9	
2.234	ISSUE	208.9	
2.3	MEDICAL+DENTAL (MEDICAL)	300.0	
2.4	GENERAL SERVICES	1455.1	
2.41	SHIP STORE FACILITIES	541.9	
2.411	SHIP STORE	270.4	
2.416	SHIP STORE STORES	271.6	
2.42	LAUNDRY FACILITIES	645.7	
2.43	DRY CLEANING		
2.44	BARBER SERVICE	160.0	
2.46	POSTAL SERVICE	95.5	
2.47	BRIG		
2.48	RELIGIOUS	12.0	
2.5	PERSONNEL STORES	237.1	59.5
2.51	BAGGAGE	83.5	
2.52	MESSROOM STORES	83.5	29.5
2.55	FOUL WEATHER GEAR (LOCKER)	30.0	30.0

2.57	FOLDING CHAIR STOREROOM	40.0	
2.6	CBR PROTECTION	184.4	
2.61	CBR DECON STATIONS		
2.62	CBR DEFENSE EQP STRMS	184.4	
2.63	CPS AIRLOCKS		
2.7	LIFESAVING EQUIPMENT	20.0	
2.71	LIFEJACKET LOCKER	20.0	

PRINTED REPORT NO. 4 - SHIP SUPPORT AREA

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2
3.	SHIP SUPPORT	58718.1	8311.3
3.1	SHIP CNTL SYS(STEERING&DIVING)	1568.7	
3.2	DAMAGE CONTROL	2132.8	
3.22	REPAIR STATIONS	1274.7	
3.25	FIRE FIGHTING	858.1	
3.3	SHIP ADMINISTRATION	6810.0	
3.5	DECK AUXILIARIES	2159.2	
3.51	ANCHOR HANDLING	936.9	
3.52	LINE HANDLING	1222.3	
3.6	SHIP MAINTENANCE	3495.0	
3.61	ENGINEERING DEPT	2794.6	
3.611	AUX (FILTER CLEANING)	90.0	
3.612	ELECTRICAL	698.5	
3.613	MECH (GENERAL WK SHOP)	1946.1	
3.614	PROPULSION MAINTENANCE	60.0	
3.62	OPERATIONS DEPT (ELECT SHOP)	211.3	
3.63	WEAPONS DEPT (ORDINANCE SHOP)	419.1	
3.64	DECK DEPT (CARPENTER SHOP)	70.0	
3.7	STOWAGE	10618.0	974.9
3.71	SUPPLY DEPT	4542.6	
3.711	HAZARDOUS MATL (FLAM LIQ)	698.5	
3.712	SPECIAL CLOTHING	159.4	
3.713	GEN USE CONSUM+REPAIR PART	2563.7	
3.714	MISCELLANEOUS		
3.715	STORES HANDLING	1121.0	
3.72	ENGINEERING DEPT	1746.1	
3.73	OPERATIONS DEPT	455.8	244.5
3.74	DECK DEPT (BOATSWAIN STORES)	3873.5	730.4
3.8	ACCESS (INTERIOR-NORMAL)	31934.5	7336.5

PRINTED REPORT NO. 5 - SHIP MACHINERY SYSTEM AREA

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2
4.	SHIP MACHINERY SYSTEM	11777.0	8696.2
4.1	PROPULSION SYSTEM	8301.4	3939.2
4.13	INTERNAL COMBUSTION	699.6	53.2
4.132	COMBUSTION AIR		
4.133	EXHAUST	159.6	53.2
4.134	CONTROL	540.0	
4.14	GAS TURBINE	7601.8	3886.0
4.142	COMBUSTION AIR	2869.2	1673.7
4.143	EXHAUST	3792.5	2212.3
4.144	CONTROL	940.0	
4.17	AUX PROPULSION SYSTEMS		
4.2	PROPULSOR & TRANSMISSION SYST		
4.3	AUX MACHINERY	3475.6	4756.9
4.31	GENERAL (AUX MACH DELTA)	-9605.2	
4.32	A/C & REFRIGERATION	9392.3	4756.9
4.321	A/C (INCL VENT)	9290.9	4756.9
4.322	REFRIGERATION	101.4	
4.33	ELECTRICAL	1598.7	
4.331	POWER GENERATION	1463.9	
4.3311	SHIP SERVICE PWR GEN	1463.9	
4.3314	400 HERTZ		
4.332	PWR DIST & CNTRL	9.8	
4.334	DEGAUSSING	125.0	
4.34	POLUTION CONTROL SYSTEMS	243.6	
4.35	MECHANICAL SYSTEMS	1846.1	

PRINTED REPORT NO. 6 - REQUIRED TANKAGE

POLLUTION CNTRL IND-PRESENT

ENDURANCE FUEL, FT3	128597.
AVIATION FUEL, FT3	22050.
FRESH WATER, FT3	2437.
SEWAGE, FT3	846.
WASTE OIL WATER, FT3	2572.
CLEAN BALLAST, FT3	35493.
TANKAGE MARGIN, FT3	0.
TANKAGE VOL REQ, FT3	191995.

PRINTED REPORT NO. 1 - DESIGN SUMMARY

SHIP COMMENT TABLE

PRINCIPAL CHARACTERISTICS - FT	
LBP	630.0
LOA	653.8
BEAM, DWL	90.0
BEAM, WEATHER DECK	99.5
DEPTH @ STA 10	62.0
DRAFT TO KEEL DWL	23.2
DRAFT TO KEEL LWL	23.2
FREEBOARD @ STA 3	42.8
GMT	9.0
CP	0.570
CX	0.910

SPEED(KT): MAX= 30.6 SUST= 29.3
ENDURANCE: 6000.0 NM AT 16.0 KTS

TRANSMISSION TYPE: ELECT
MAIN ENG: 4 GT @ 26250.0 HP

SHAFT POWER/SHAFT: 48930.0 HP
PROPELLERS: 2 - FP - 17.5 FT DIA

SEP GEN: 2 F DIESEL @ 2000.0 KW

24 HR LOAD 4353.7
MAX MARG ELECT LOAD 12897.5

	OFF	CPO	ENL	TOTAL
MANNING	42	27	340	409
ACCOM	43	28	351	422

WEIGHT SUMMARY - LTON	
GROUP 1 - HULL STRUCTURE	6764.7
GROUP 2 - PROP PLANT	1058.4
GROUP 3 - ELECT PLANT	973.7
GROUP 4 - COMM + SURVEIL	169.8
GROUP 5 - AUX SYSTEMS	1008.8
GROUP 6 - OUTFIT + FURN	1142.0
GROUP 7 - ARMAMENT	1134.0
SUM GROUPS 1-7	12251.4
DESIGN MARGIN	1532.9
LIGHTSHIP WEIGHT	13784.3
LOADS	5887.7
FULL LOAD DISPLACEMENT	19672.0
FULL LOAD KG: FT	40.0

MILITARY PAYLOAD WT - LTON 1929.0
USABLE FUEL WT - LTON 1775.8

AREA SUMMARY - FT2	
HULL AREA	- 142336.0
SUPERSTRUCTURE AREA	- 80230.2
TOTAL AREA	222566.2

VOLUME SUMMARY - FT3	
HULL VOLUME	- 2689995.3
SUPERSTRUCTURE VOLUME	- 802301.8
TOTAL VOLUME	3492297.0

PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.05

	SHIPS CREW	FLAG STAFF /AIR DET	TROOPS	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	20.	18.	4.	42.	43.
CPO	16.	3.	8.	27.	28.
OEM	220.	36.	84.	340.	351.
TOTAL	256.	57.	96.	409.	422.

PRINTED REPORT NO. 3 - INDICATORS

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MISSION
  DESIGN MODE IND-ENDURANCE
  ENDUR DISP IND -FULL LOAD
  ENDUR DEF IND  -USN
  SUSTN SPEED IND-CALC
  ENDUR SPEED IND-GIVEN
HULL FORM FACTORS
  HULL OFFSETS IND-GENERATE
  HULL DIM IND    -T
HULL BOUNDARY CONDITIONS
  HULL BC IND     -GIVEN
  HULL STA IND    -OPTIMUM
SHELL APPENDAGES
  BILGE KEEL IND -PRESENT
  SKEG IND        -NONE
MARGIN LINE
  MARGIN LINE IND-CALC
HULL SUBDIVISION FACTORS
  HULL SUBDIV IND-GIVEN
INNER BOTTOM
  INNER BOTTOM IND-PRESENT
HULL LOADS
  HULL LOADS IND -CALC
STRUCTURAL ARANGEMENT
  BOT PLATE LIMIT IND-CALC
STIFFENERS
  STIFFENER SHAPE IND-CALC
DKHS GEOM FACTORS
  DKHS GEOM IND  -GIVEN
  DKHS SIZE IND  -
DKHS MATERIALS
  DKHS MTRL TYPE IND-MS
  FIRE PROTECT IND   -NONE
DKHS LOADS
  BLAST RESIST IND-3 PSI
ARRANGEMENT TYPES
  MECH CL ARR IND    -
  MECH PORT ARR IND -
  MECH STBD ARR IND -
  ELECT PG ARR 1 IND-M-PG
  ELECT PG ARR 2 IND-
  ELECT DL ARR IND   -MTR
ARRANGEMENT CG
  MACHY KG IND   -GIVEN
ENGINE CONFIG FACTORS
  ENG ENDUR RPM IND    -CALC
  SEC ENG USAGE IND    -
  ENDUR CONFIG IND     -NO TS
  GT ENG ENCL IND      -84 DBA
  DIESEL ENG MOUNT IND-COMPOUND
MAIN ENGINES
  MAIN ENG SELECT IND-GIVEN
  MAIN ENG MOD IND -GE-LM2500-30
  MAIN ENG TYPE IND  -GT
  MAIN ENG SFC EQ IND-EXPNT
  MAIN ENG SIZE IND  -GIVEN
SEC ENGINES
ELECTRICAL TRANSMISSION
  ELECT PRPLN TYPE IND  -ACC-AC
  ELECT PRPLN RATIND IND-CALC
  AC SYNC ROTOR COOL IND-AIR
  TRANS LINE NODE PT IND-CALC
  SWITCHGEAR TYPE IND   -ADV
GEARS
  SEC ENG 2 SPD GEAR IND-NONE
  GEAR IMPED MASS IND   -PRESENT
PROPULSION SHAFTING
  SHAFT SUPPORT TYPE IND-OPEN STRUT
  SHAFT SYS SIZE IND    -CALC
PROPULSION SHAFT BEARING
  THRUST BRG LOC IND-CALC
PROPELLER FACTORS
  PROP TYPE IND  -FP
  PROP SERIES IND-ANALYTIC
  PROP DIA IND   -CALC
  PROP AREA IND  -CALC
  PROP LOC IND   -CALC
  PITCH RATIO IND-CALC
OPEN WATER PROP DATA
  PROP ID IND    -
PROPULSION SUPPORT SYS
  INLET TYPE IND      -PLENUM
  DUCT SILENCING IND -BOTH
  EXHAUST IR SUPP IND-PRESENT
SS GENERATOR FACTORS
  SS SYS TYPE IND-SEP
SS GENERATOR SIZE
  SS GEN SIZE IND-GIVEN
SS ENGINES
  SS ENG SELECT IND -GIVEN
  SS ENG MODEL IND  -MTU-16V538
  SS ENG TYPE IND   -F DIESEL
  SS ENG SFC EQN IND-DIESEL
  SS ENG SIZE IND   -GIVEN
SONAR SYSTEM
  SONAR DOME IND -NONE
  SONAR DRAG IND -
CLIMATE CONTROL
  COLL PROTECT SYS IND-PRESENT
  REFER MACHY LOC IND -
  AUX BOILER TYPE IND -NONE
RUDDERS
  RUDDER SIZE IND-CALC
  RUDDER TYPE IND-SPADE
ROLL FINS
  FIN SIZE IND   -CALC
SPECIAL PURPOSE SYSTEMS
  POLLUTION CNTL IND-PRESENT
OUTFIT AND FURNISHINGS
  UNIT CMDR IND   -FLAG
FUELS AND LUBRICANTS
  SHIP FUEL TYPE IND-DFM
RESISTANCE FACTORS
  FRICTION LINE IND   -ITTC
```

SEC ENG SELECT IND -
SEC ENG MODEL IND -
SEC ENG TYPE IND -
SEC ENG SFC EQN IND-
SEC ENG SIZE IND -
TRANSMISSION FACTORS
TRANS TYPE IND -ELECT
TRANS EFF IND -CALC

RESID RESIST IND -H+M
WORM CURVE IND -AUX REGR
PRPLN SYS RESIST IND-CALC

PRINTED REPORT NO. 4 - MARGINS

HULL	
MIN FREEBOARD MARGIN, FT	.25
HULL MARGIN STRESS, KSI	2.24
PROPULSION PLANT	
TORQUE MARGIN FAC	1.200
ELECTRIC PLANT	
ELECT LOAD DES MARGIN FAC	.200
ELECT LOAD SL MARGIN FAC	.200
AUXILIARY SYSTEMS	
AC MARGIN FAC	.200
OUTFIT AND FURNISHINGS	
CREW ACCOM MARGIN FAC	.050
WEIGHT MARGINS	
PD WT MARGIN FAC	.024
PD KG MARGIN FAC	.024
CD WT MARGIN FAC	.024
CD KG MARGIN FAC	.024
D+B WT MARGIN FAC	.053
D+B KG MARGIN FAC	.053
CON MOD WT MARGIN FAC	.014
CON MOD KG MARGIN FAC	.014
GFM WT MARGIN FAC	.006
GFM KG MARGIN FAC	.006
GROWTH WT MARGIN, LTON	.0
RESISTANCE FACTORS	
DRAG MARGIN FAC	.080
SPACE FACTORS	
SPACE MARGIN FAC	.050
PASSWAY MARGIN FAC	.000
TANKAGE MARGIN FAC	.000

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW	PAYLOAD AND ADJUSTMENT NAME
1	WOLF EEL (2)
2	WELL DECK PTX'S (2)
3	WELL DECK PTX'S (2)
4	WELL DECK PTX'S (2)
5	FLIGHT DECK PTX'S (2 CH-53E)
6	FLIGHT DECK PTX'S (2 CH-53E)
7	FLIGHT DECK PTX'S (2 CH-53E)
8	JP-5 FUEL
9	JP-5 FUEL
10	JP-5 FUEL
11	JP-5 FUEL
12	DFM FOR PTX'S
13	DFM FOR PTX'S
14	DFM FOR PTX'S
15	DFM FOR PTX'S
16	CRANES
17	CRANES
18	AMMO
19	AUX STEAM
20	AUX STEAM

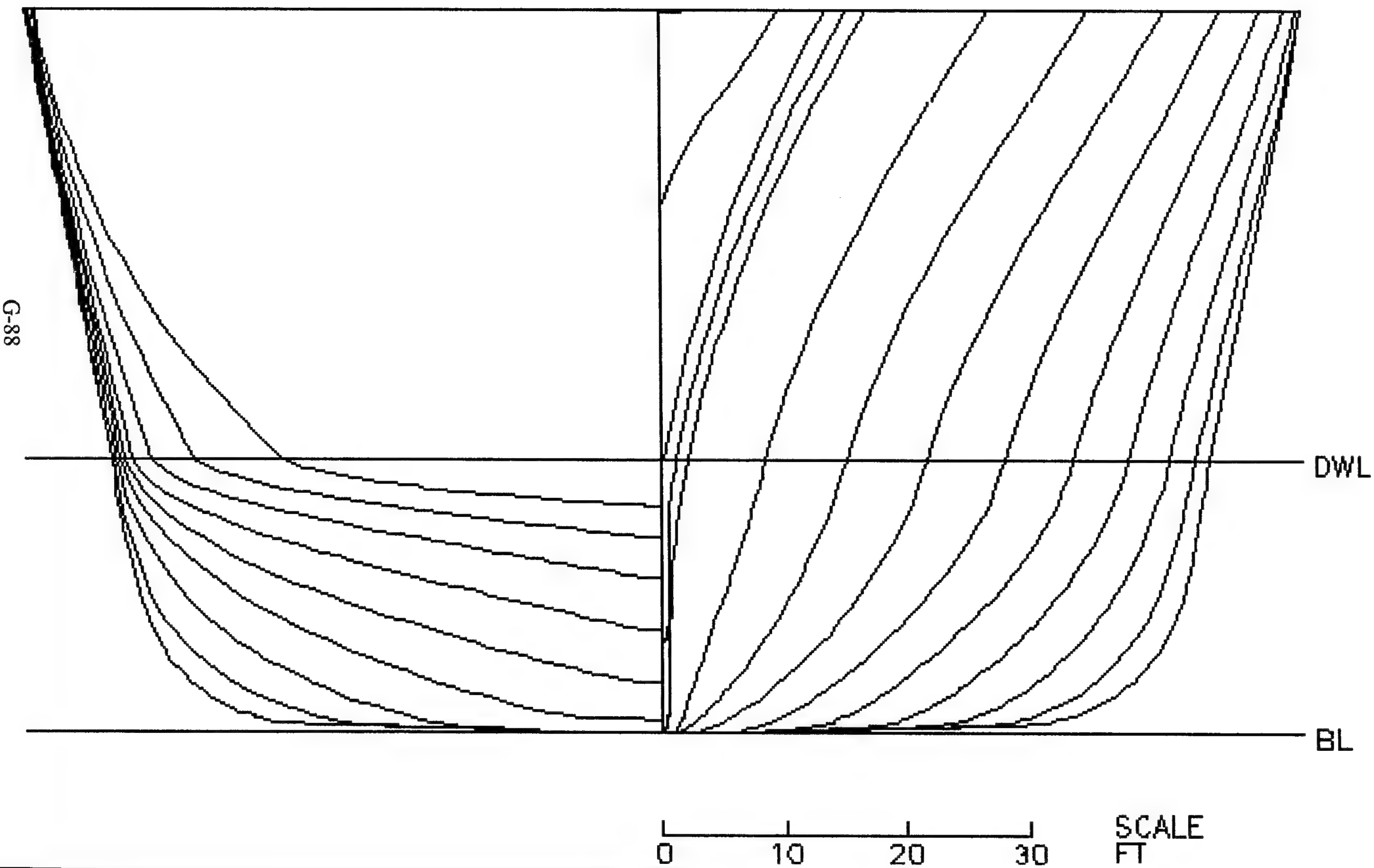
ROW	WT KEY	WT ADD LTON	WT FAC	VCG KEY	VCG ADD FT	VCG FAC
1	W791	80.00	.000	BL	50.00	.000
2	W791	260.00	.000	BL	32.00	.000
3	W791	260.00	.000	BL	32.00	.000
4	W791	260.00	.000	BL	32.00	.000
5	W791	66.00	.000	BL	69.00	.000
6	W791	66.00	.000	BL	69.00	.000
7	W791	66.00	.000	BL	69.00	.000
8	WF42	125.00	.000	BL	4.50	.000
9	WF42	125.00	.000	BL	4.50	.000
10	WF42	125.00	.000	BL	4.50	.000
11	WF42	125.00	.000	BL	4.50	.000
12	WF41	115.00	.000	BL	4.50	.000
13	WF41	115.00	.000	BL	4.50	.000
14	WF41	115.00	.000	BL	4.50	.000
15	WF41	115.00	.000	BL	4.50	.000
16	W573	10.00	.000	BL	72.00	.000
17	W580	10.00	.000	BL	72.00	.000
18	WF21	371.00	.000	BL	8.00	.000
19	W534	.00	.000	BL	.00	1.000
20	W535	.00	.000	BL	.00	1.000

ROW	AREA KEY	---AREA ADD, FT2-- HULL/SS	SS/ONLY	-----AREA FAC----- HULL/SS	SS/ONLY
1	NONE	.00	.00	.000	.000
2	NONE	.00	.00	.000	.000
3	NONE	.00	.00	.000	.000
4	NONE	.00	.00	.000	.000
5	NONE	.00	.00	.000	.000
6	NONE	.00	.00	.000	.000
7	NONE	.00	.00	.000	.000
8	NONE	.00	.00	.000	.000
9	NONE	.00	.00	.000	.000
10	NONE	.00	.00	.000	.000
11	NONE	.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	NONE	.00	.00	.000	.000
14	NONE	.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	NONE	.00	.00	.000	.000
18	NONE	.00	.00	.000	.000
19	NONE	.00	.00	.000	.000
20	NONE	.00	.00	.000	.000

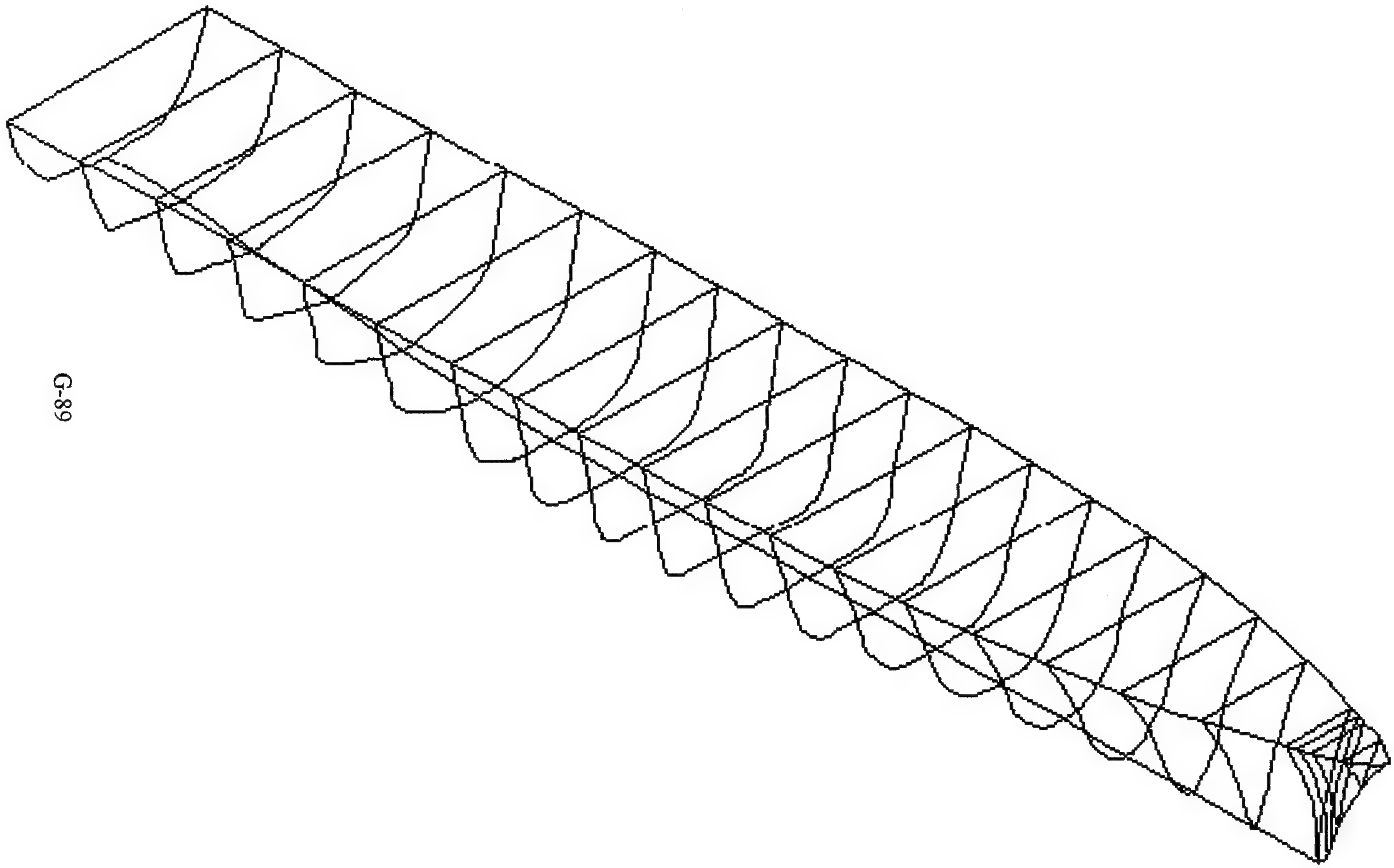
ROW	KW KEY	--------KW ADD, KW--------- W CRUISE	W BATTLE	S CRUISE	------------KW FAC---------- W CRUISE	W BATTLE	S CRUISE
1	NONE	.00	.00	.00	.000	.000	.000
2	NONE	.00	.00	.00	.000	.000	.000
3	NONE	.00	.00	.00	.000	.000	.000
4	NONE	.00	.00	.00	.000	.000	.000
5	NONE	.00	.00	.00	.000	.000	.000
6	NONE	.00	.00	.00	.000	.000	.000
7	NONE	.00	.00	.00	.000	.000	.000
8	NONE	.00	.00	.00	.000	.000	.000
9	NONE	.00	.00	.00	.000	.000	.000
10	NONE	.00	.00	.00	.000	.000	.000
11	NONE	.00	.00	.00	.000	.000	.000
12	NONE	.00	.00	.00	.000	.000	.000
13	NONE	.00	.00	.00	.000	.000	.000
14	NONE	.00	.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	.00	.00	.00	.000	.000	.000
17	NONE	.00	.00	.00	.000	.000	.000
18	NONE	.00	.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	.00	.00	.00	.000	.000	.000

I)

ASSET/MONOLA VERSION 1.0 - HULL GEOM MODULE - 1/20/94   08.05.58.
GRAPHIC DISPLAY NO. 1 - BODY PLAN

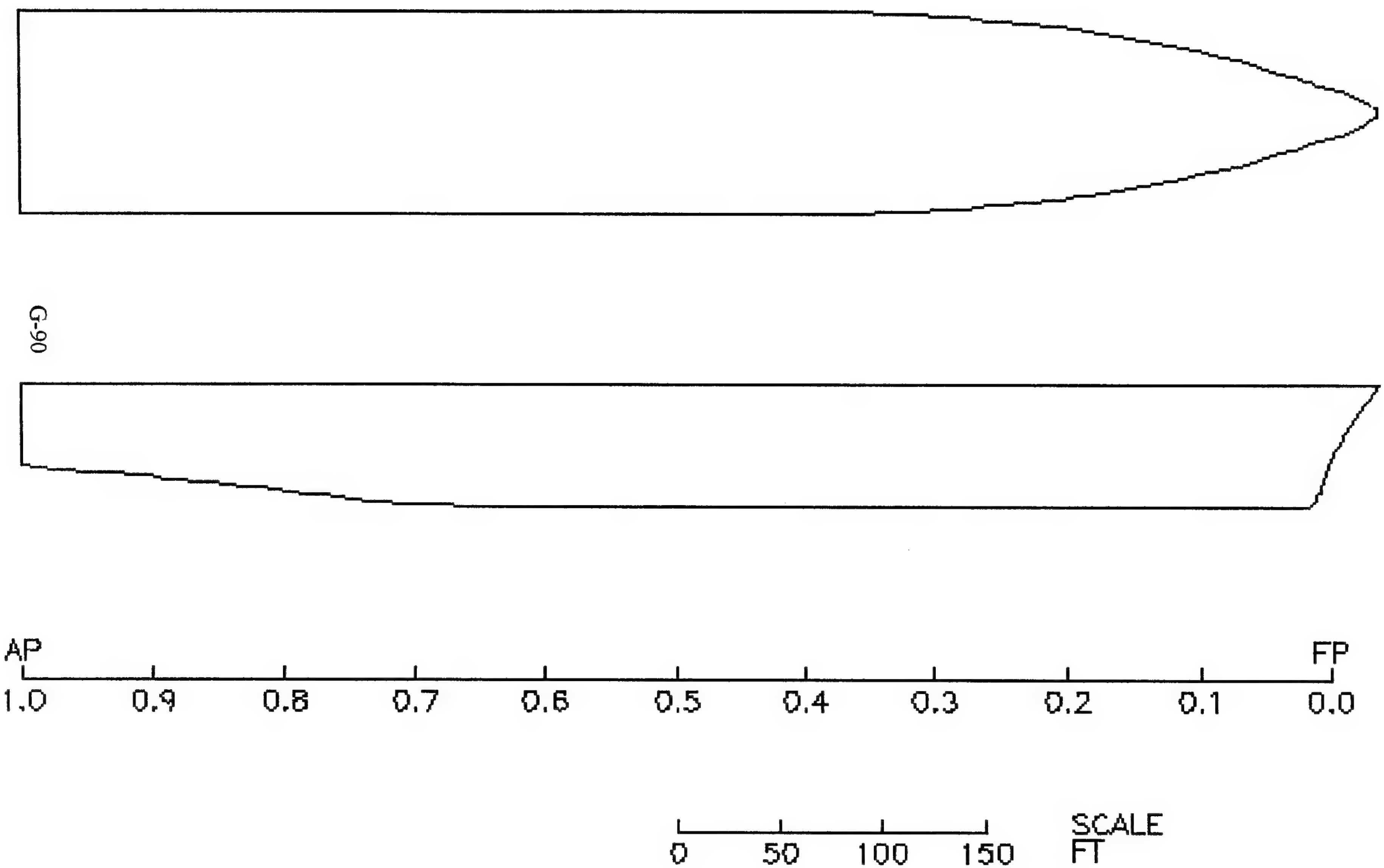


ASSET/MONOLA VERSION 1.0 - HULL GEOM MODULE - 1/20/94 08.05.58.
GRAPHIC DISPLAY NO. 2 - HULL ISOMETRIC VIEW

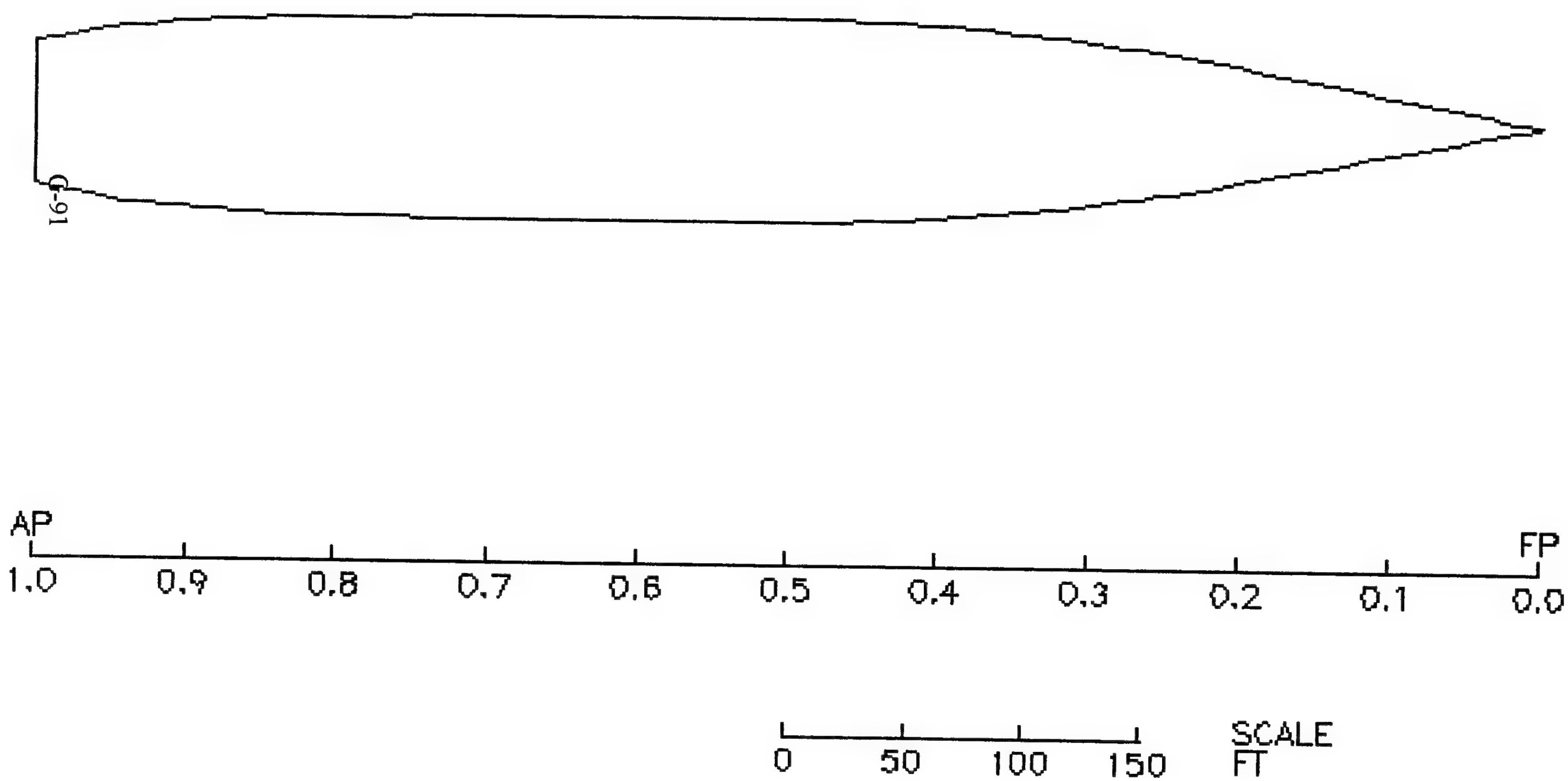


I)

ASSET/MONOLA VERSION 1.0 - HULL GEOM MODULE - 1/20/94 08.05.58.
GRAPHIC DISPLAY NO. 3 - HULL PROFILE AND WEATHER DECK PLAN VIEW

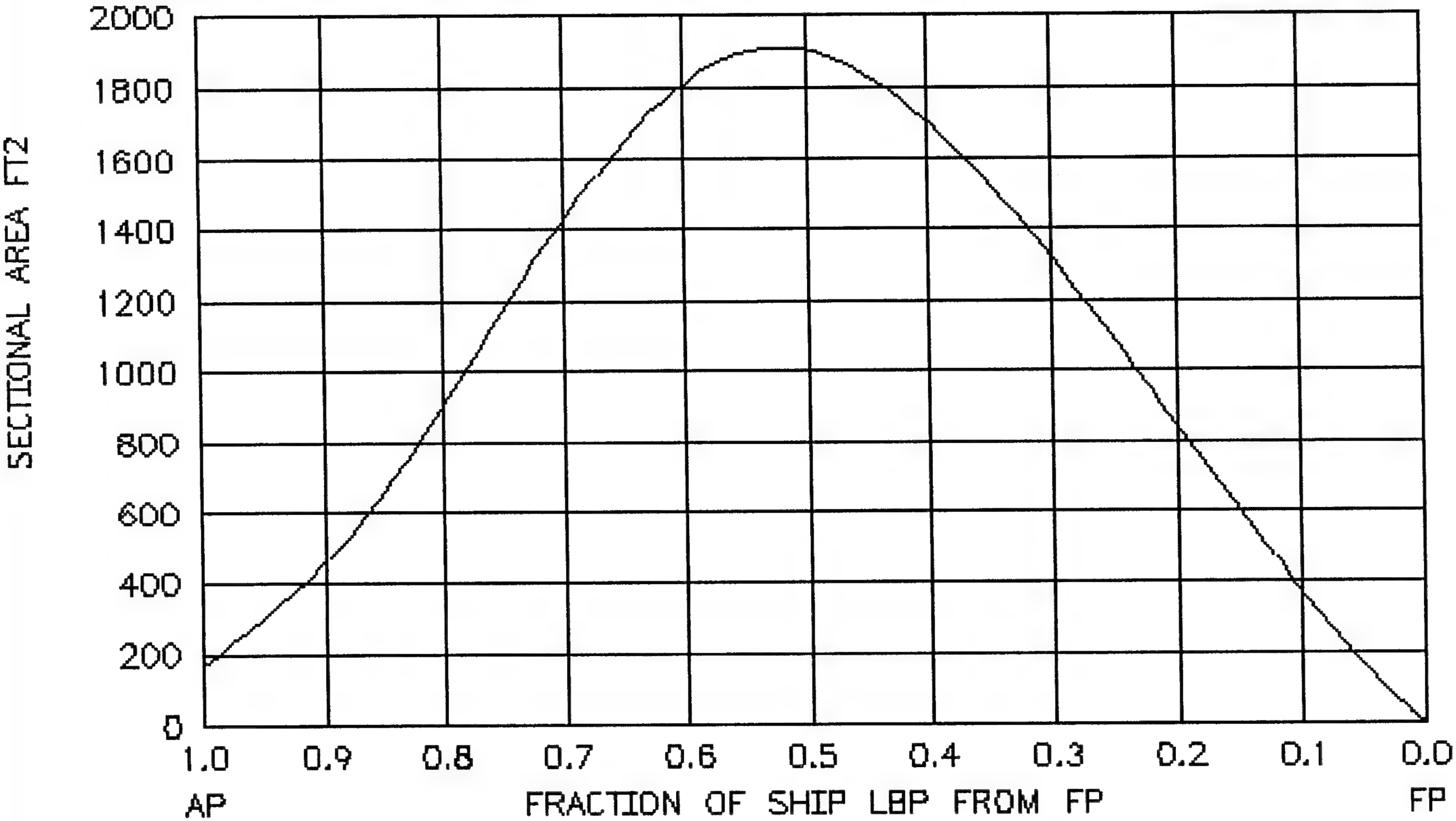


ASSET/MONOLA VERSION 1.0 - HULL GEOM MODULE - 1/20/94 08.05.58.
GRAPHIC DISPLAY NO. 4 - DESIGN WATERLINE PLAN VIEW



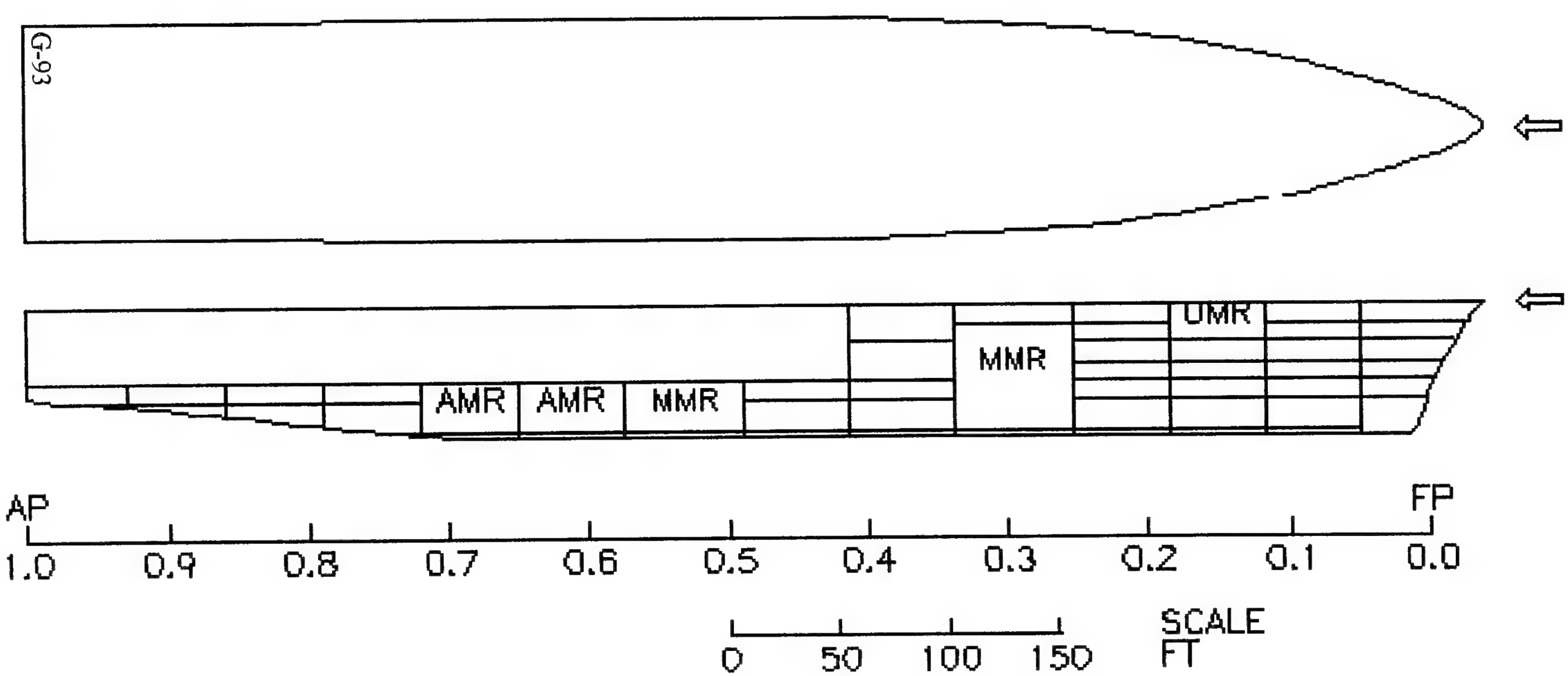
I)

ASSET/MONOLA VERSION 1.0 - HULL GEOM MODULE - 1/20/94 08.05.58.
GRAPHIC DISPLAY NO. 5 - HULL SECTIONAL AREA CURVE



ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO. 1 - HULL DECKS AND PLATFORMS
MAIN DECK
(DECK NO. 1)

DECK AREA, FT2	59859.4
TOTAL SHIP DECK AREA, FT2	142340.5
TOTAL HULL VOLUME, FT3	2684147.

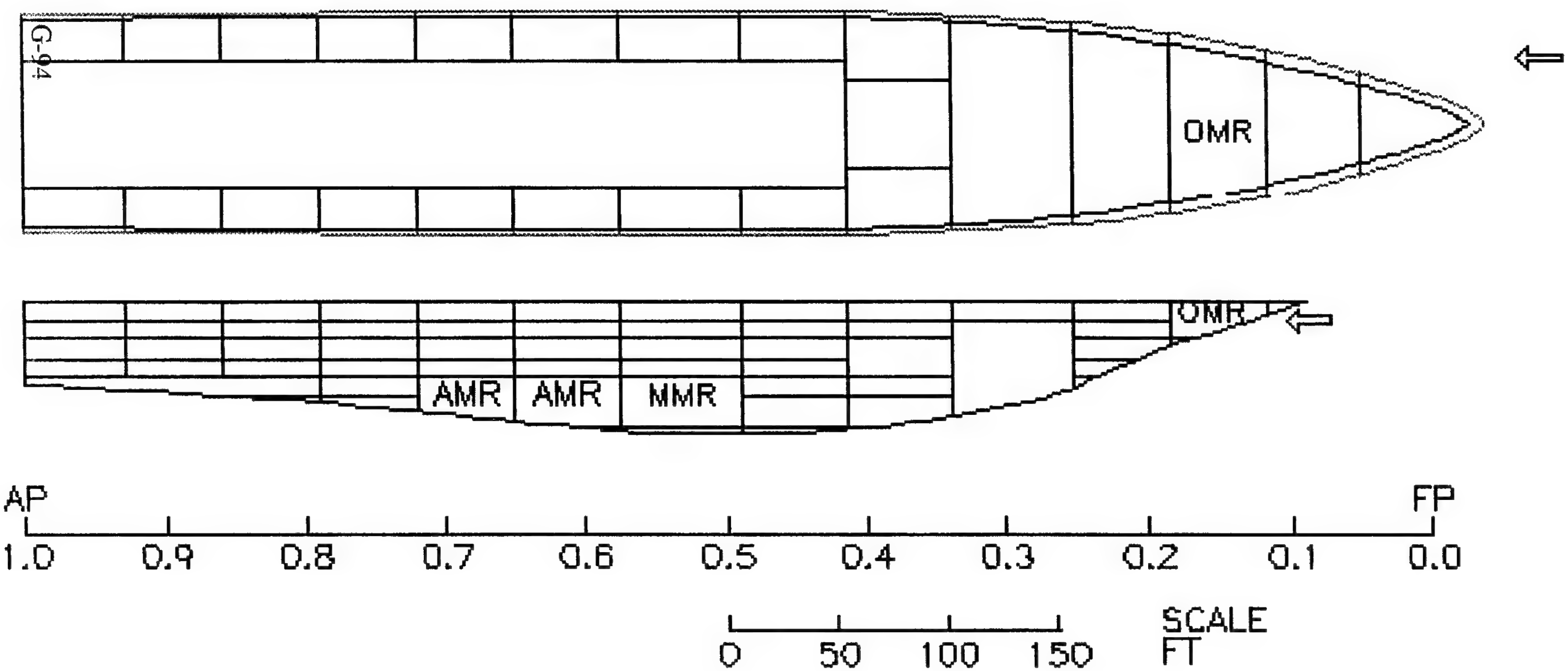


I)

ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO. 2 - HULL DECKS AND PLATFORMS
1ST PLATFORM
(DECK NO. 2)

TOTAL DECK AREA, FT2	56054.6
LOST MR AREA, FT2	0.0
LOST LC OBJ AREA, FT2	26882.5

AVL ARR AREA, FT2	29172.1

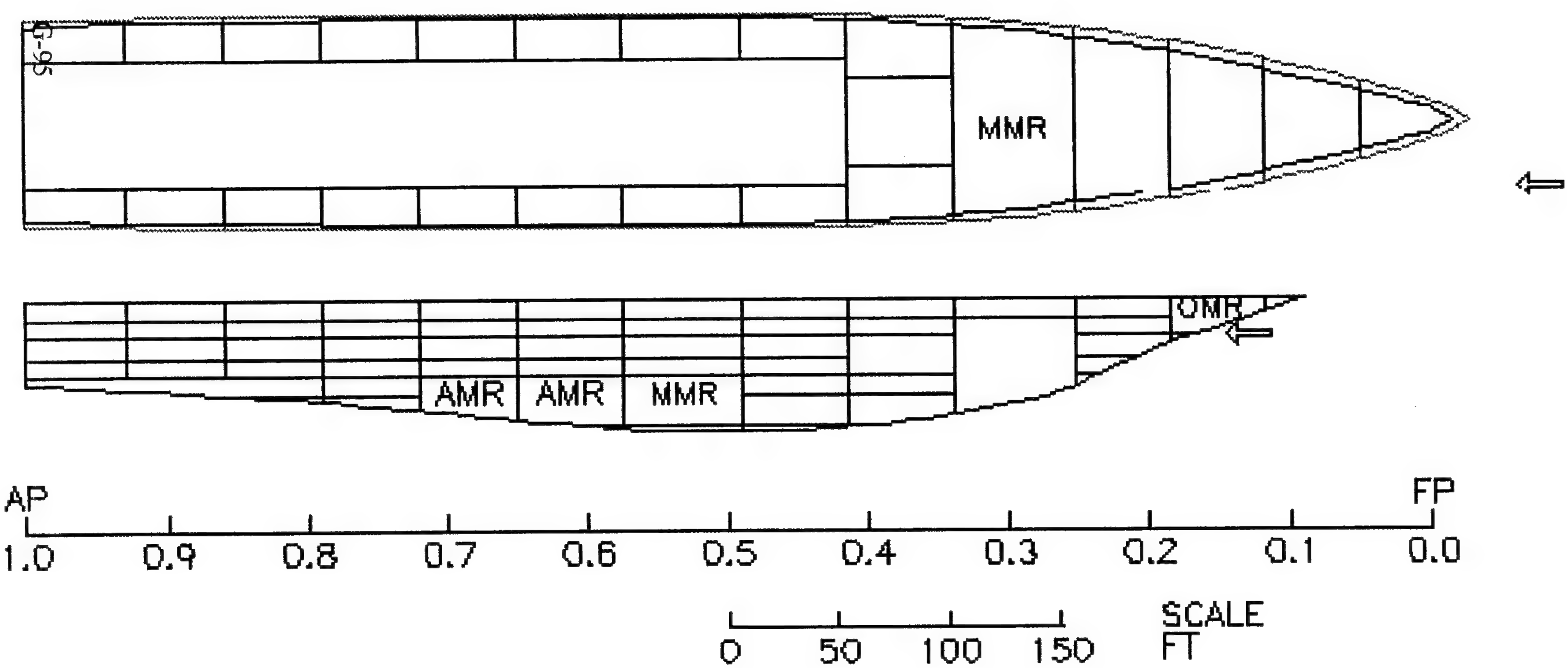


ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO. 3 - HULL DECKS AND PLATFORMS

2ND PLATFORM
(DECK NO. 3)

TOTAL DECK AREA, FT2	52320.9
LOST MR AREA, FT2	-4577.4
LOST LC OBJ AREA, FT2	22142.0

AVL ARR AREA, FT2	25601.5

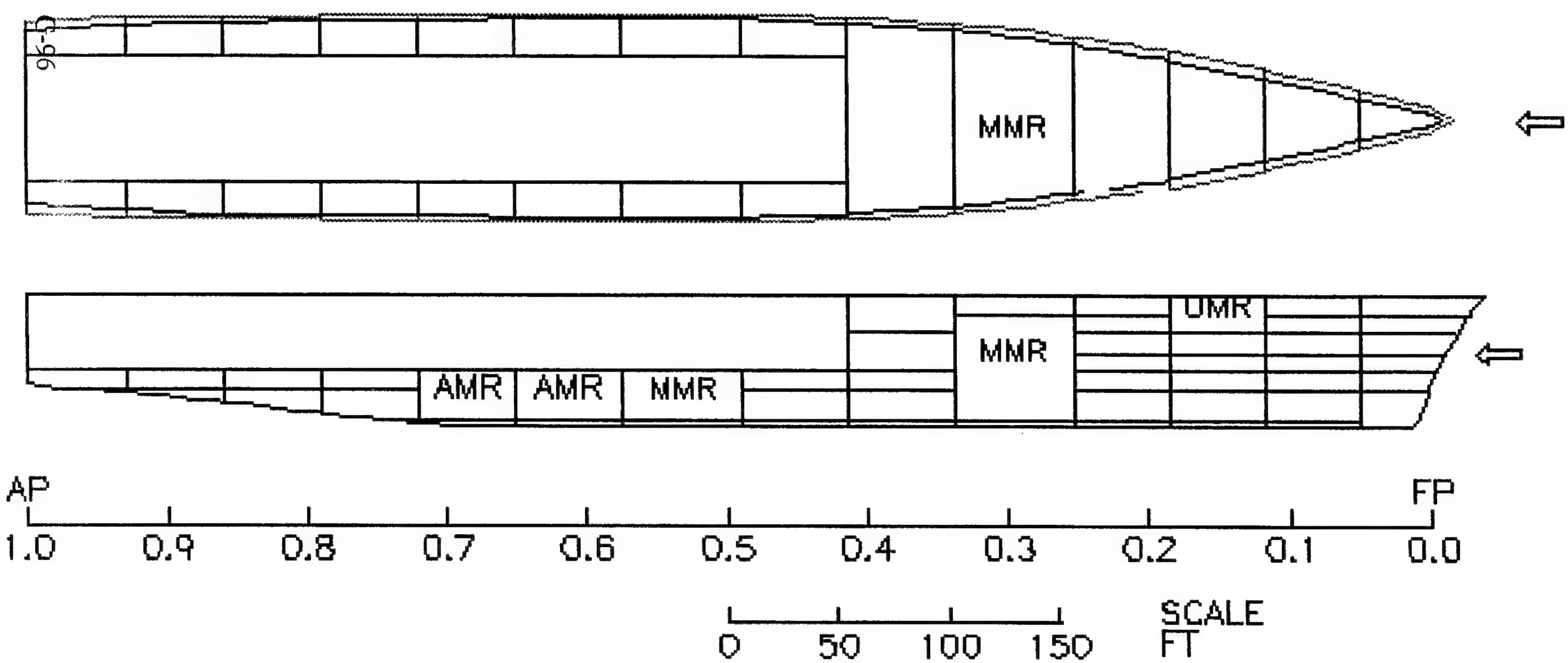


D

ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO. 4 - HULL DECKS AND PLATFORMS
3RD PLATFORM
(DECK NO. 4)

TOTAL DECK AREA, FT2	48699.1
LOST MR AREA, FT2	-4206.9
LOST LC OBJ AREA, FT2	26300.8

AVL ARR AREA, FT2	18191.4

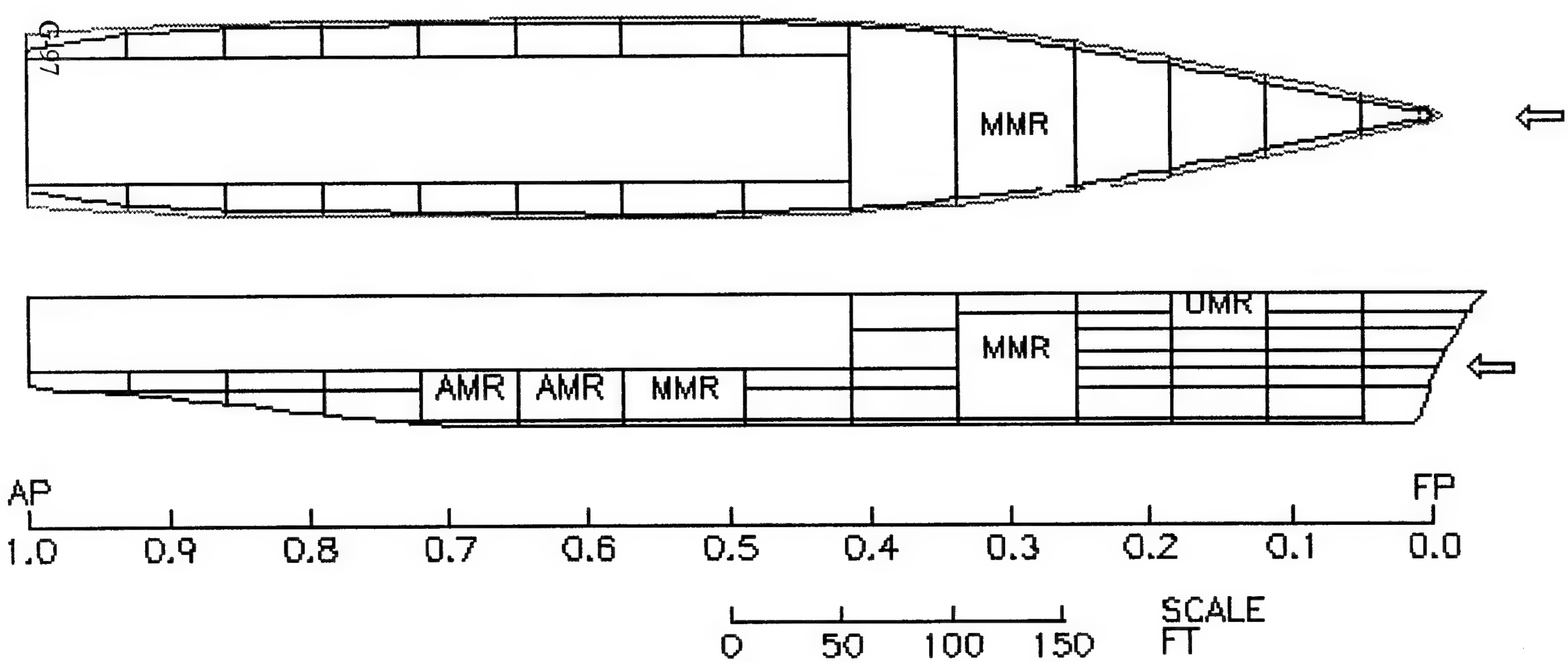


ASSET/MONOLA VERSION 1.0 – HULL SUBDIV MODULE – 1/20/94 08.22.02.
GRAPHIC DISPLAY NO. 5 – HULL DECKS AND PLATFORMS

4TH PLATFORM
(DECK NO. 5)

TOTAL DECK AREA, FT2	45023.7
LOST MR AREA, FT2	-3898.4
LOST LC OBJ AREA, FT2	0.0

AVL ARR AREA, FT2	41125.3



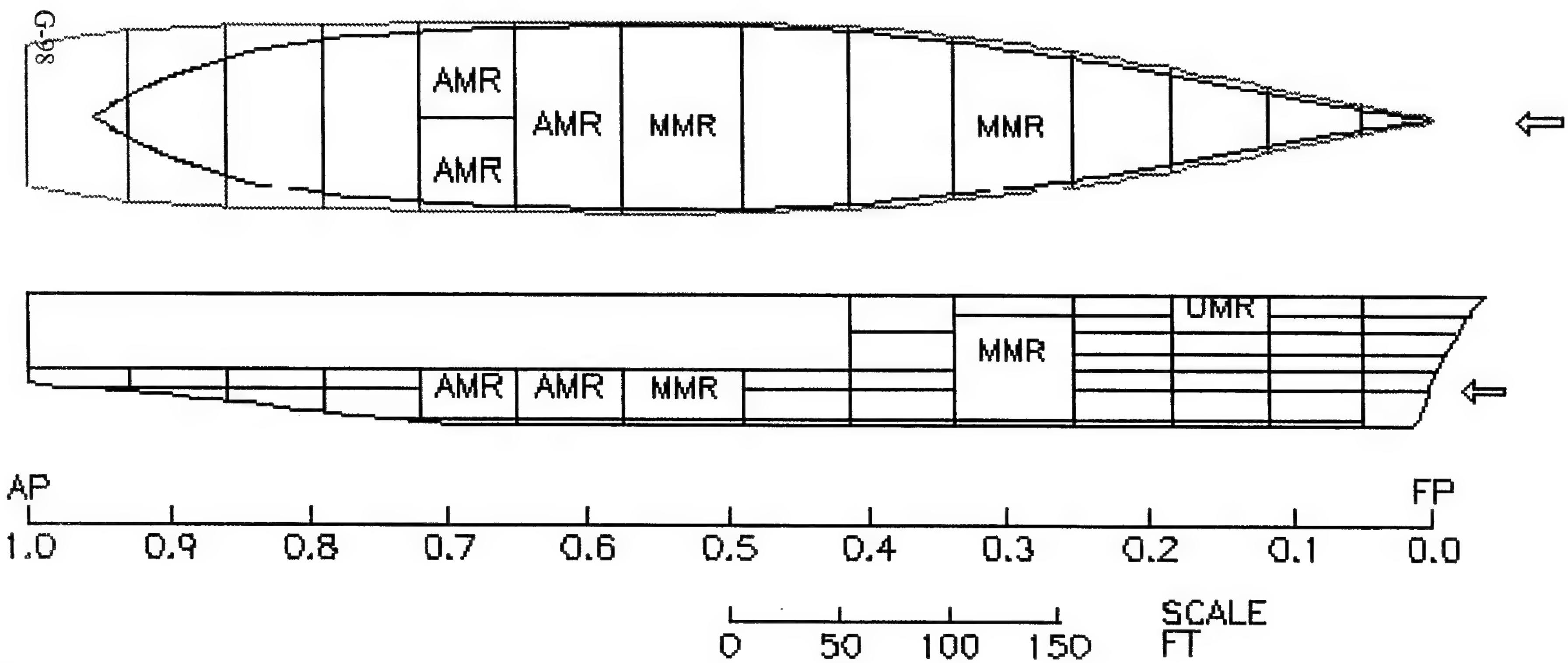
I)

ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO. 6 - HULL DECKS AND PLATFORMS

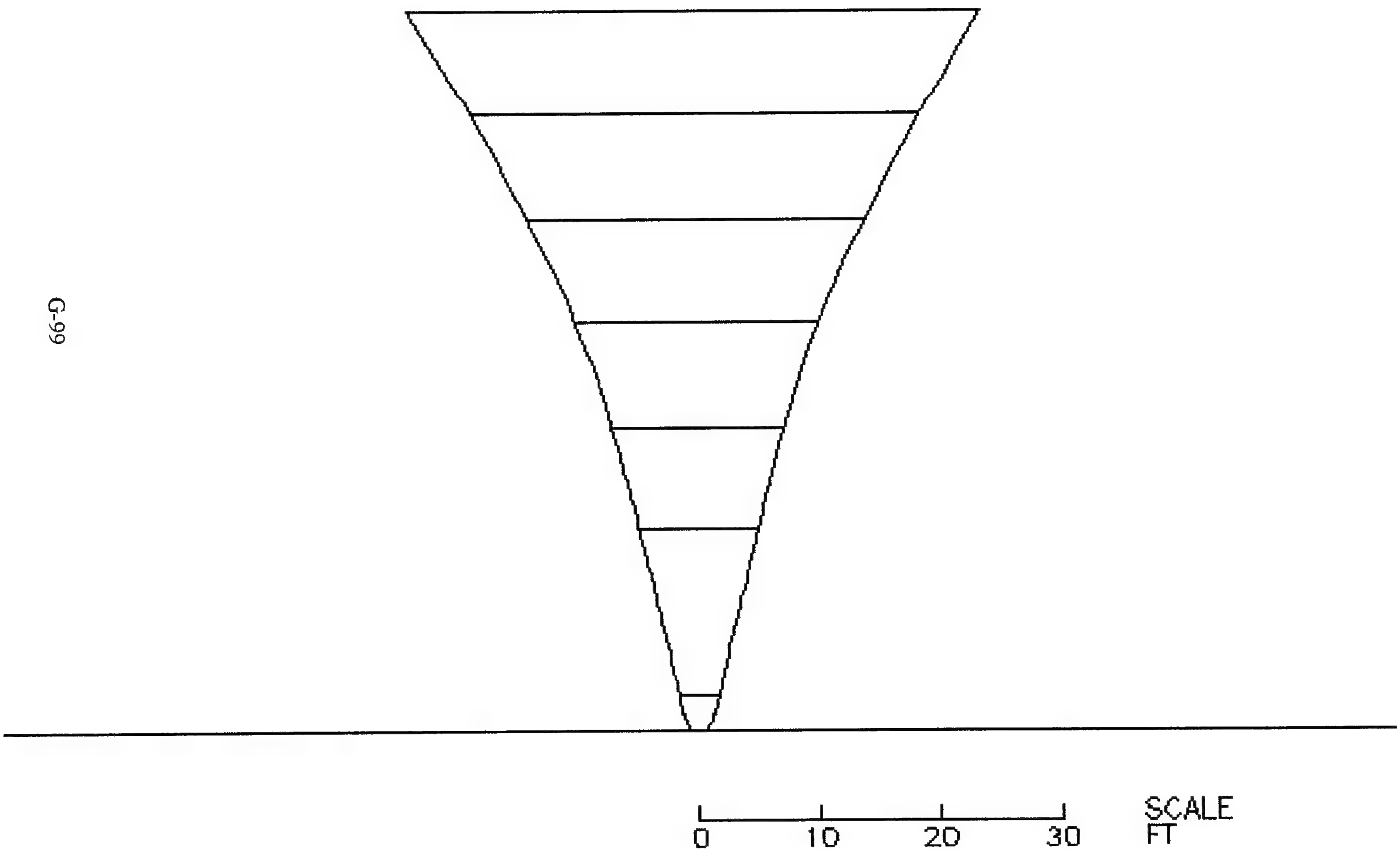
5TH PLATFORM
(DECK NO. 6)

TOTAL DECK AREA, FT2	36297.0
LOST MR AREA, FT2	-15964.4
LOST LC OBJ AREA, FT2	0.0

AVL ARR AREA, FT2	20332.5



ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.11 - SECTION AT 31.5 - TBKHD # 1



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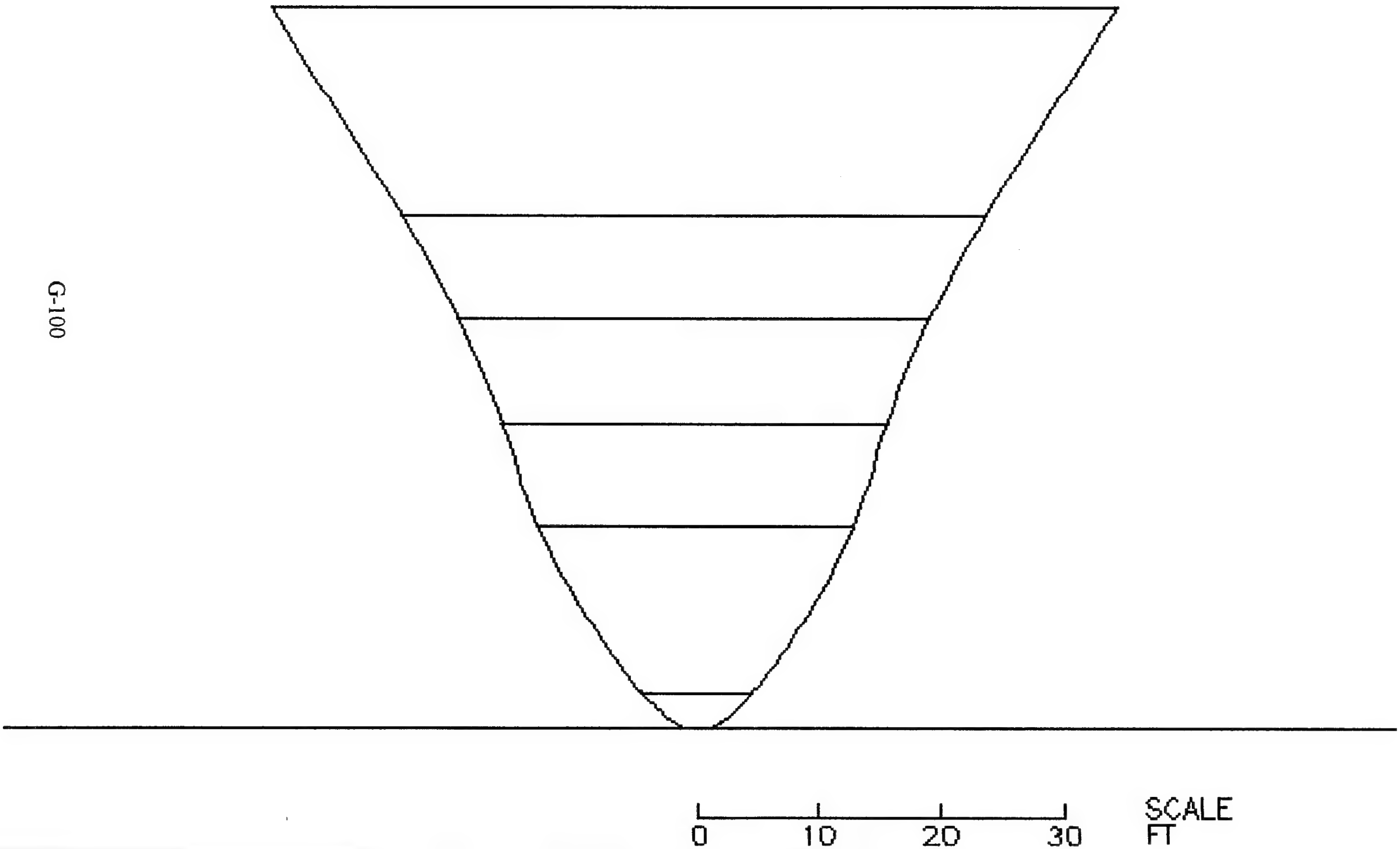
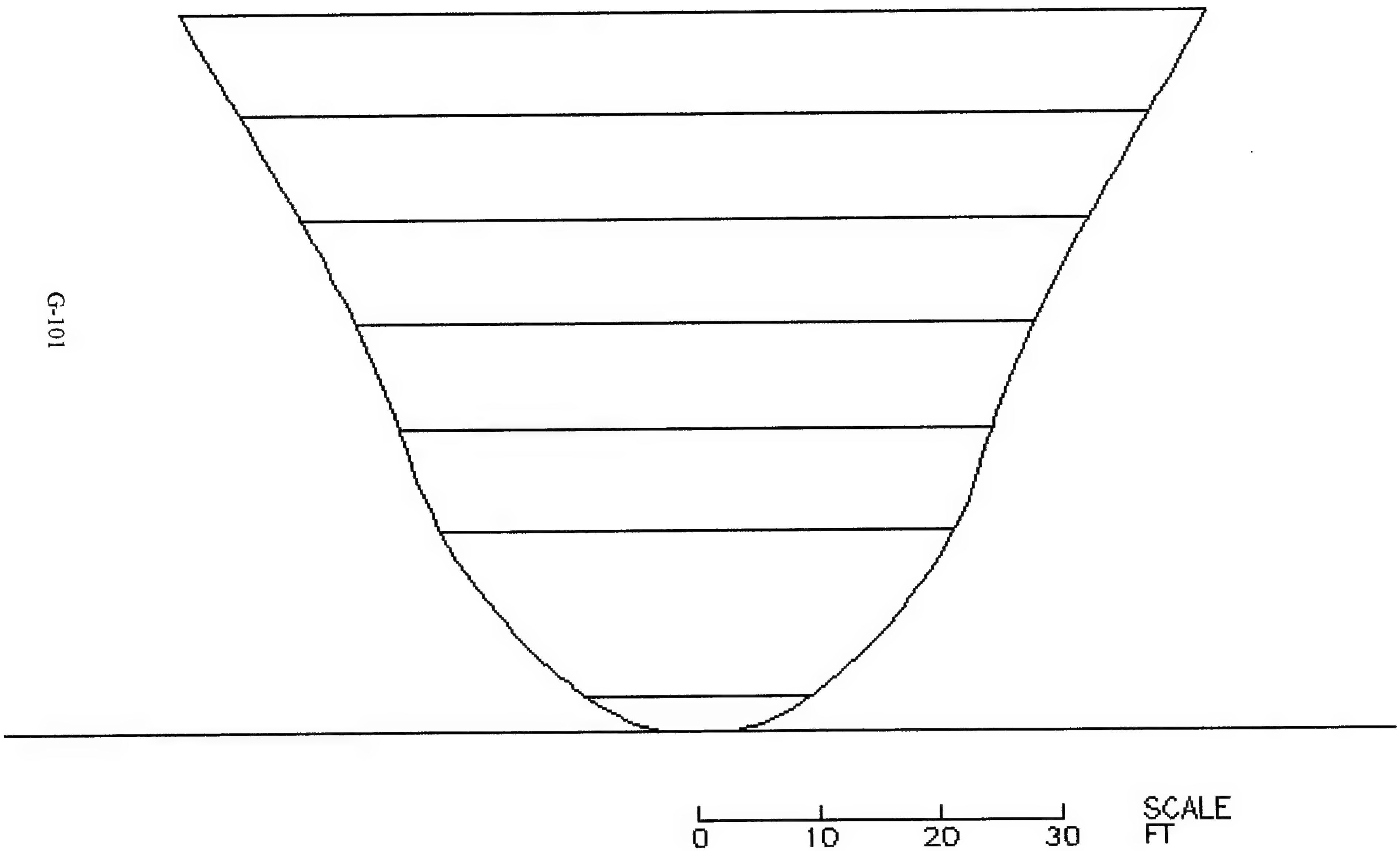
ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.12 - SECTION AT 74.2 - TBKHD # 2

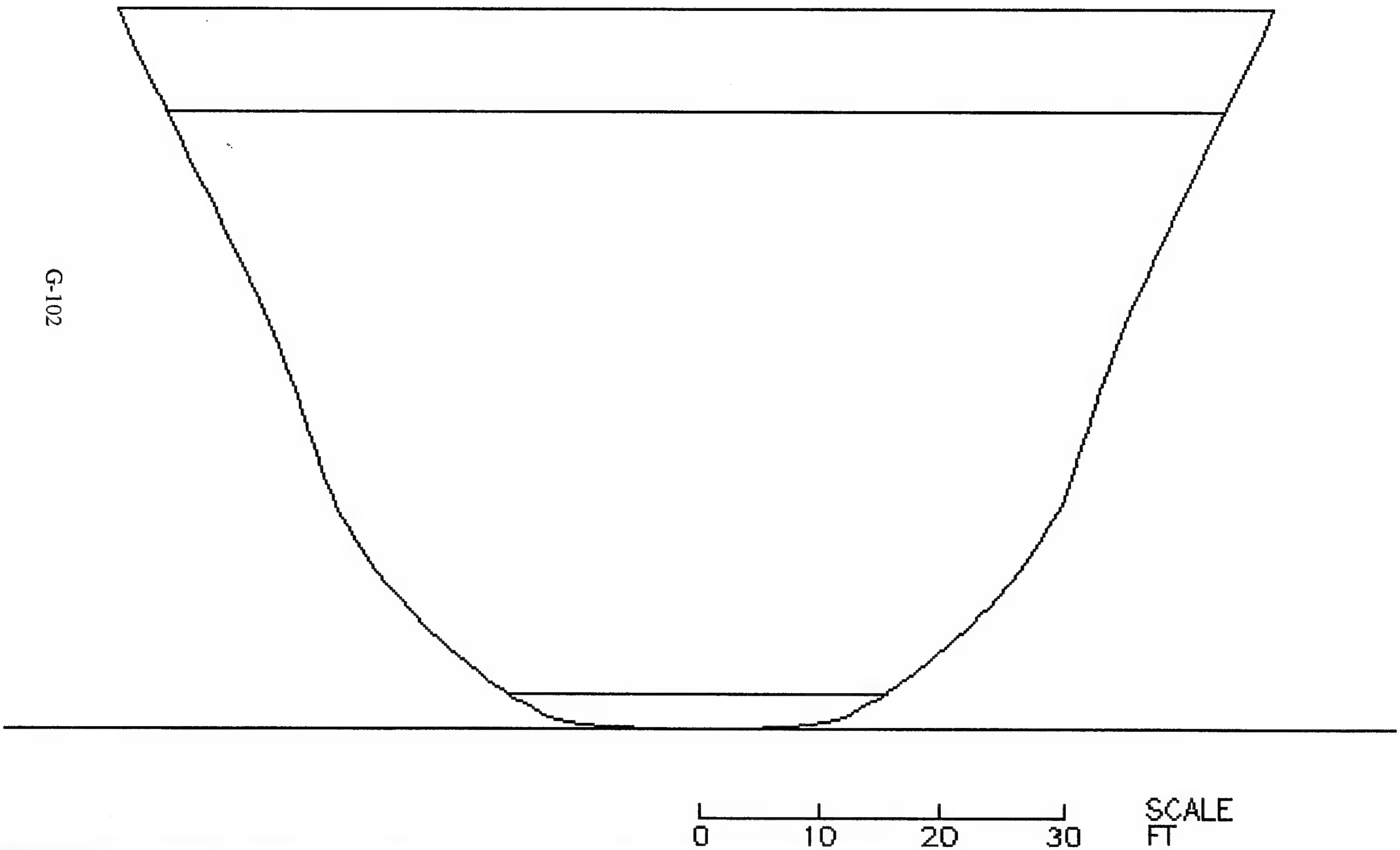


ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.13 - SECTION AT 117.0 - TBKHD # 3

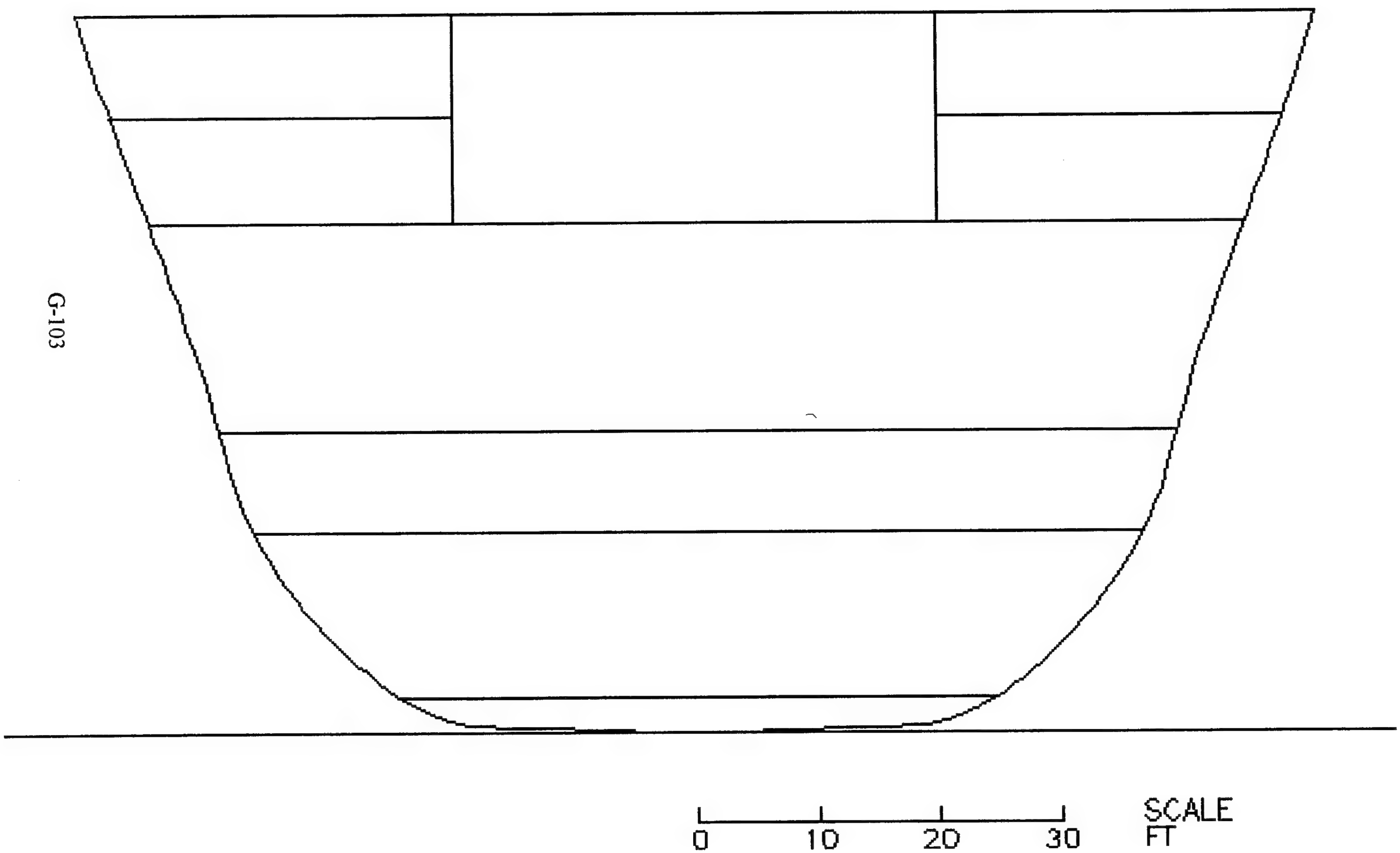


I)

ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.14 - SECTION AT 159.7 - TBKHD # 4



ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.15 - SECTION AT 213.7 - TBKHD # 5



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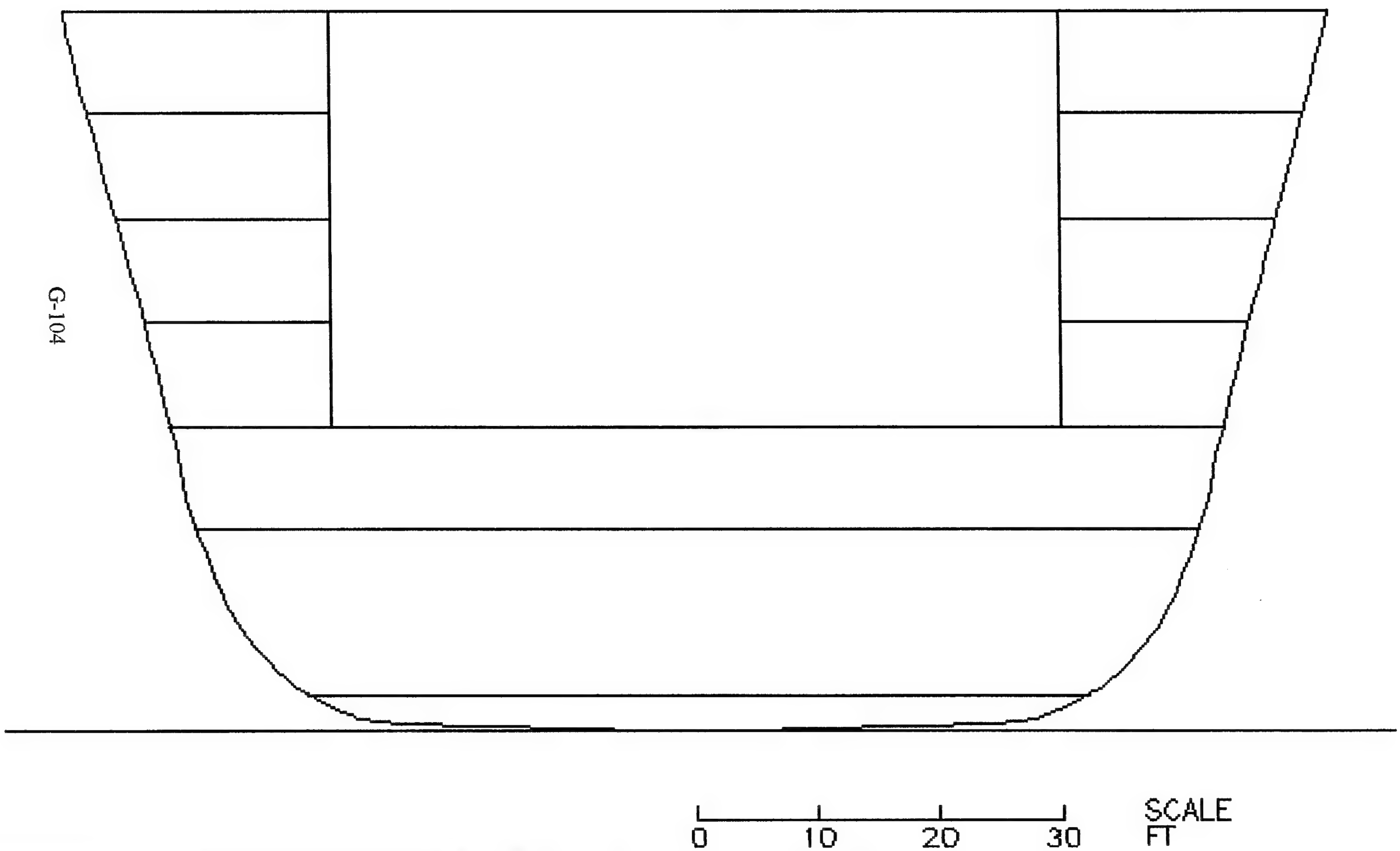
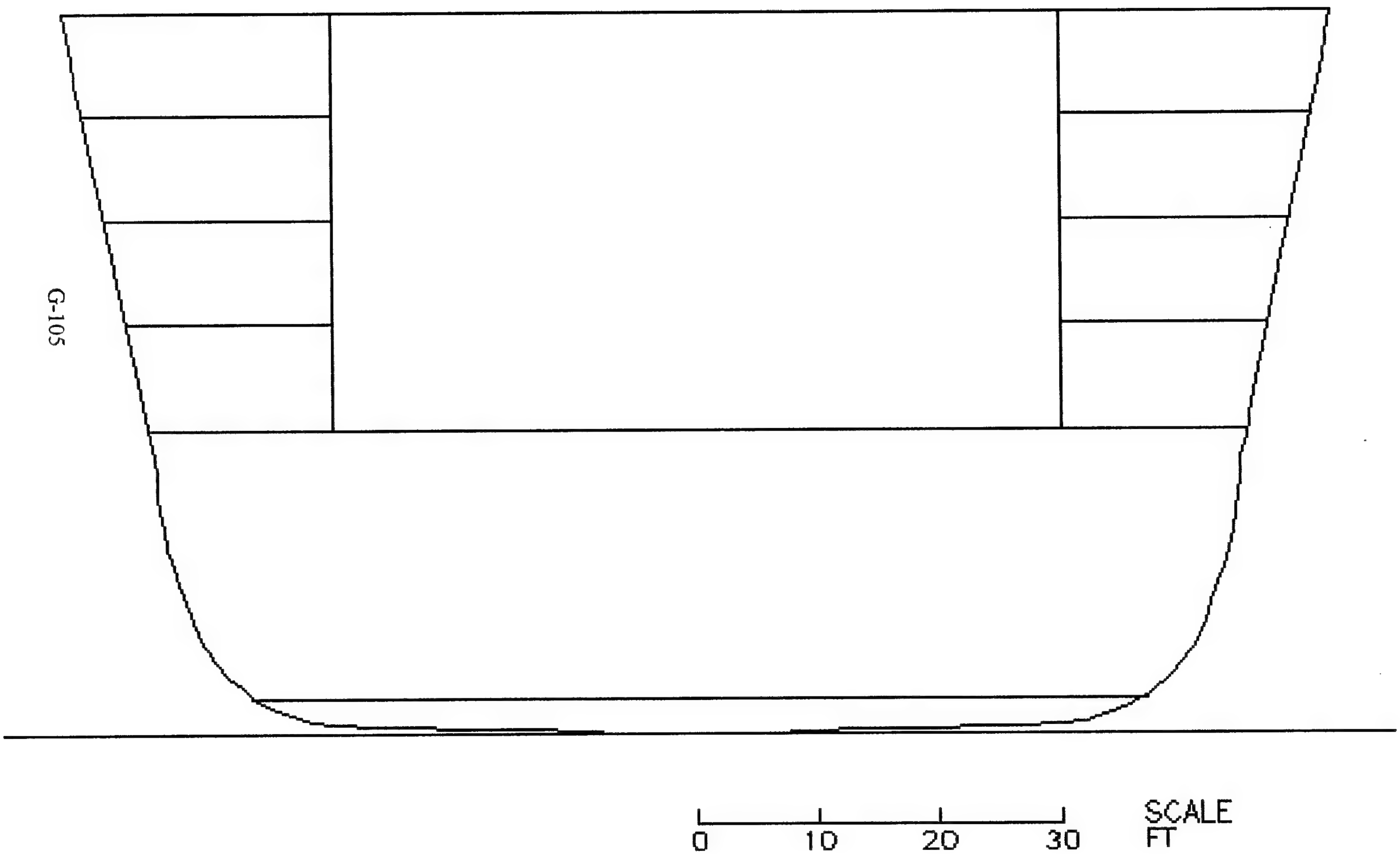
ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.16 - SECTION AT 261.0 - TBKHD # 6

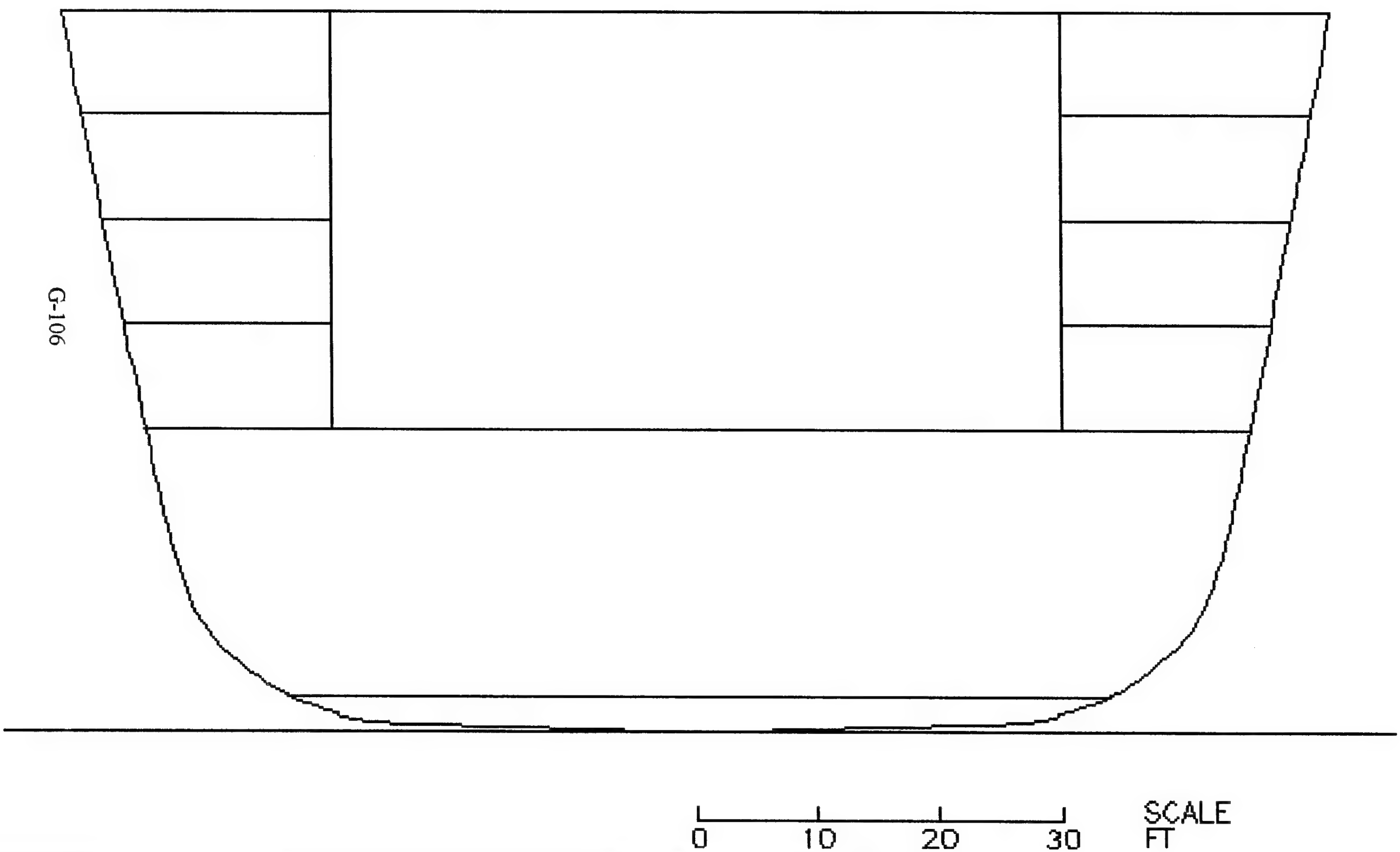


ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.17 - SECTION AT 308.2 - TBKHD # 7

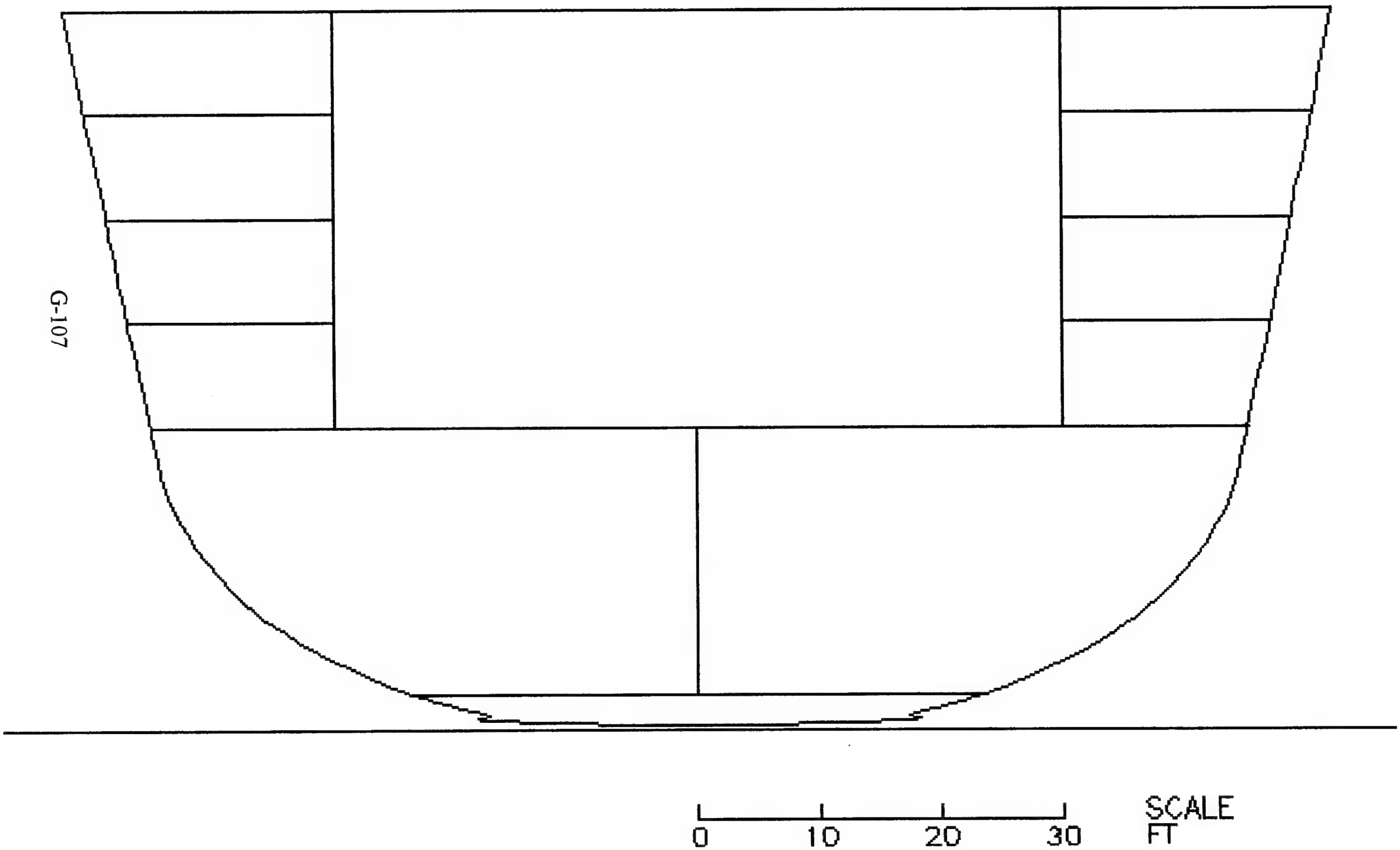


I)

ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.18 - SECTION AT 362.3 - TBKHD # 8

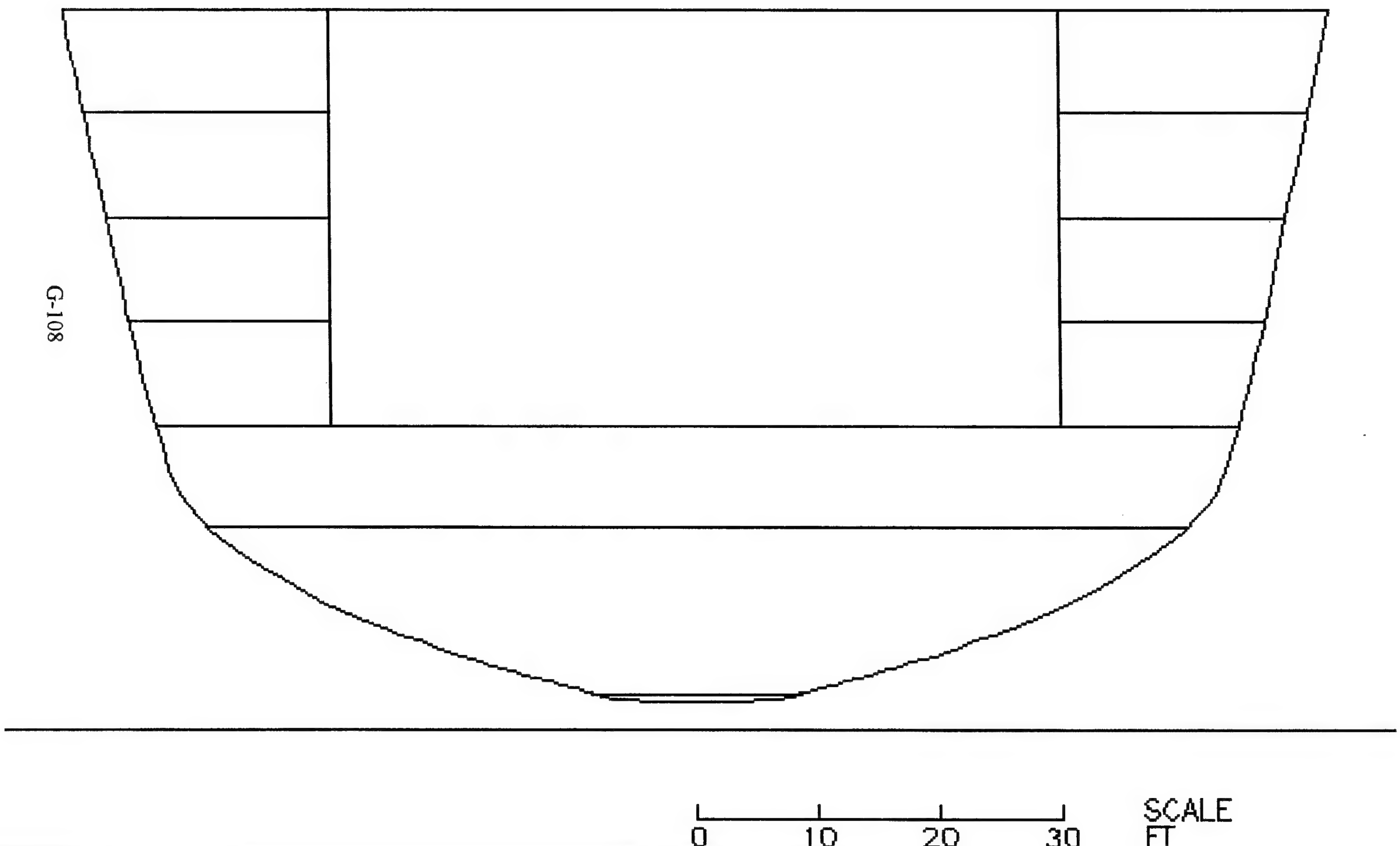


ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.19 - SECTION AT 409.5 - TBKHD # 9

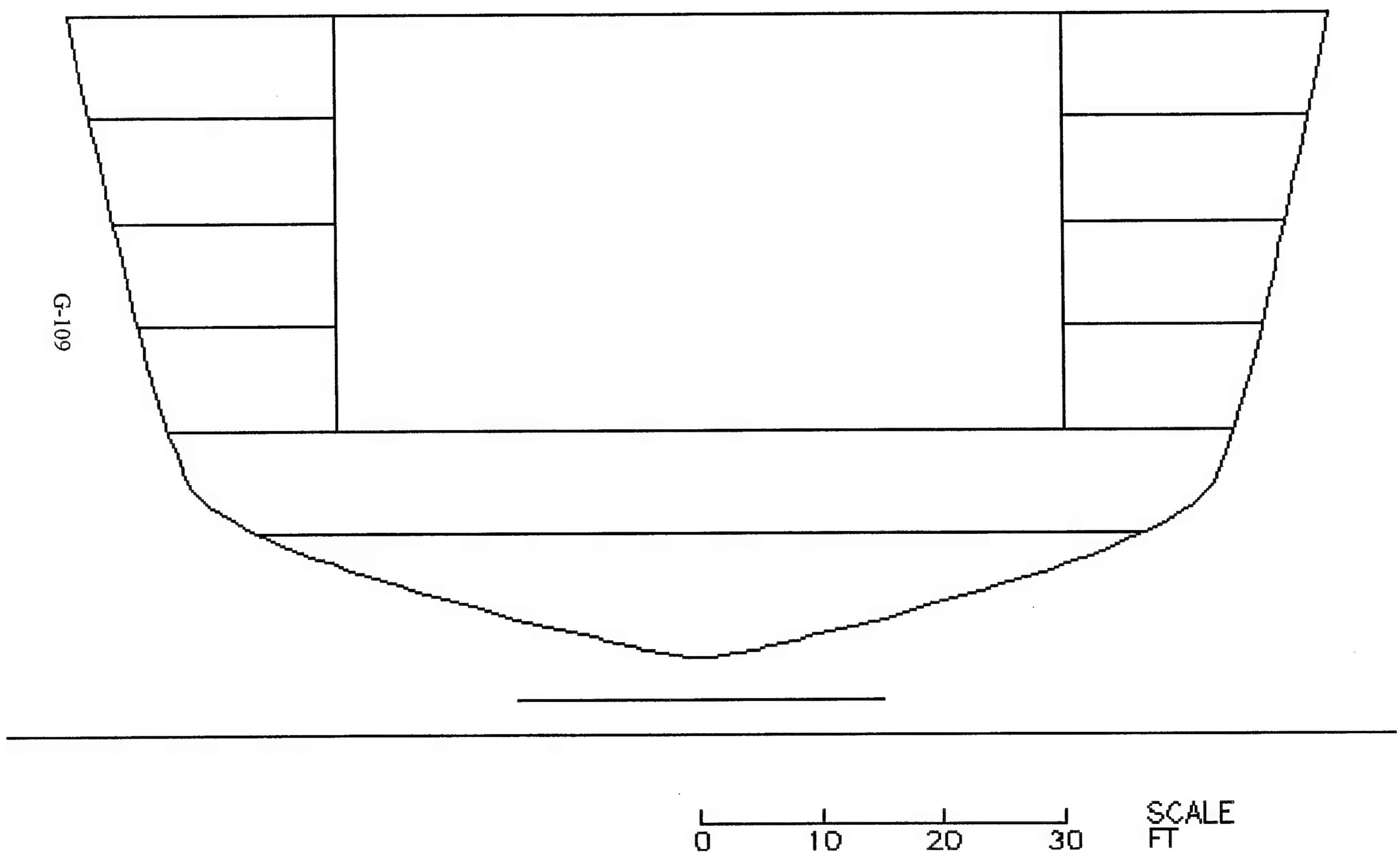


I)

ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.20 - SECTION AT 453.6 - TBKHD # 10

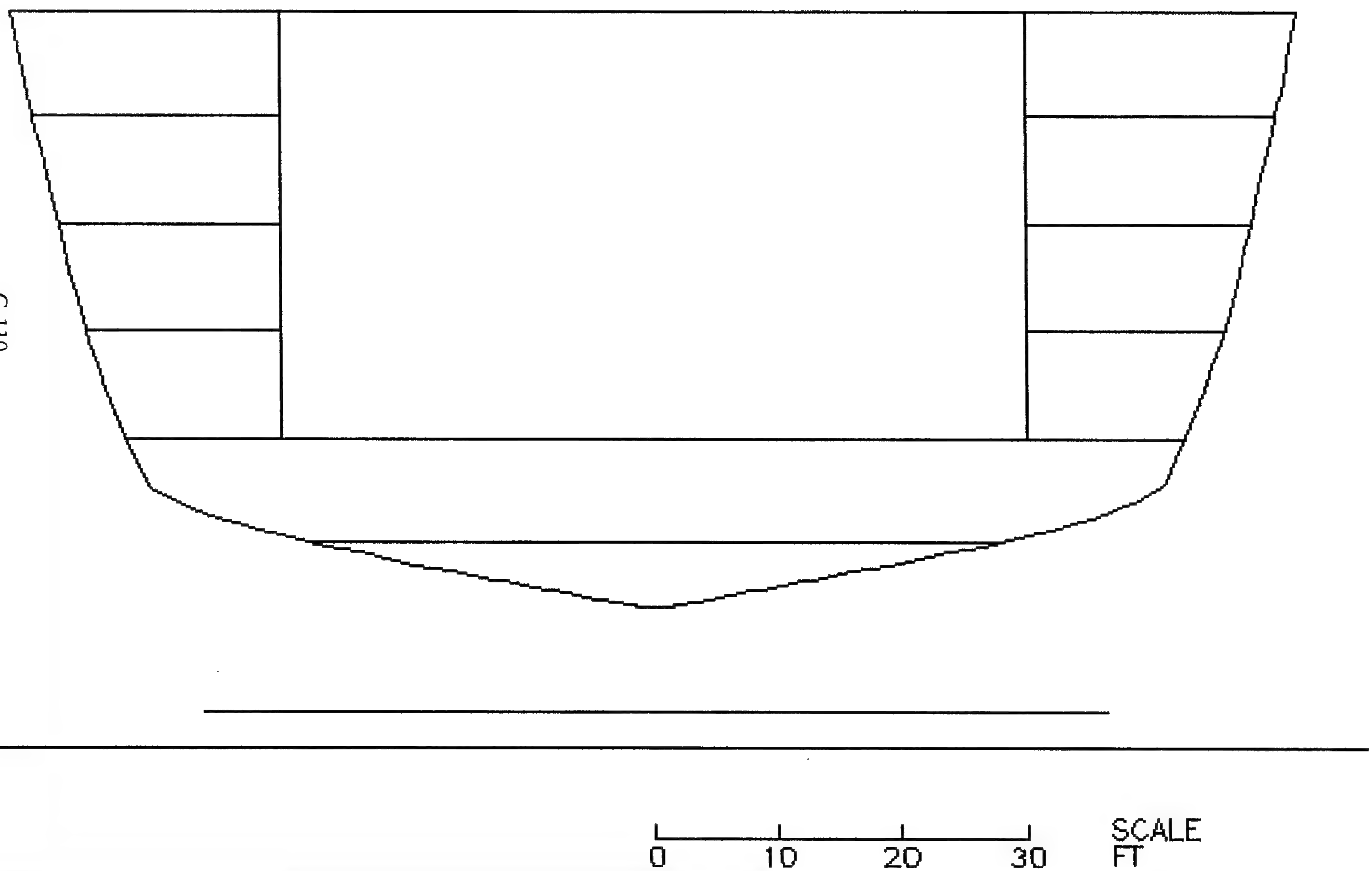


ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.21 - SECTION AT 497.7 - TBKHD # 11

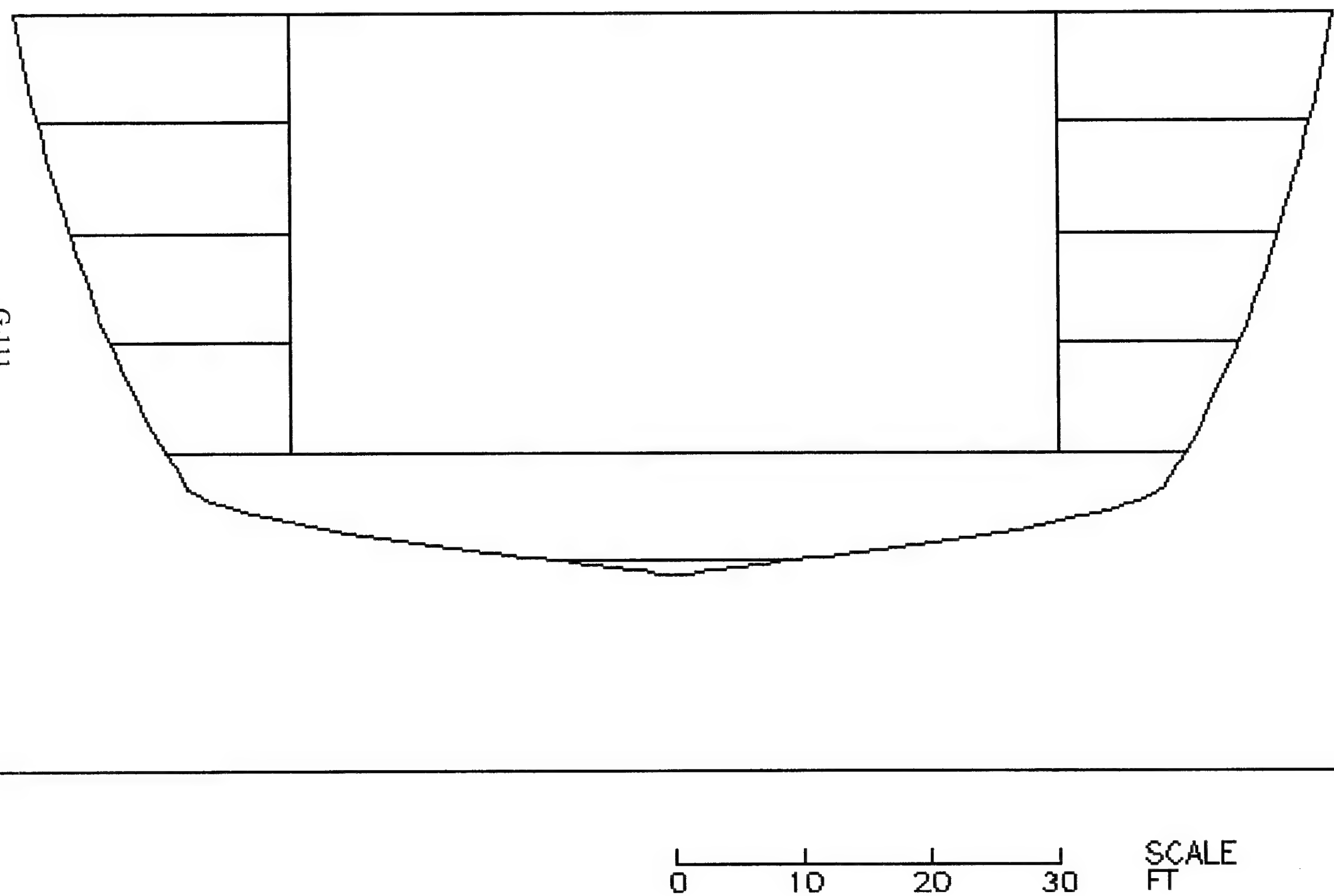


D)

ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.22 - SECTION AT 541.8 - TBKHD # 12

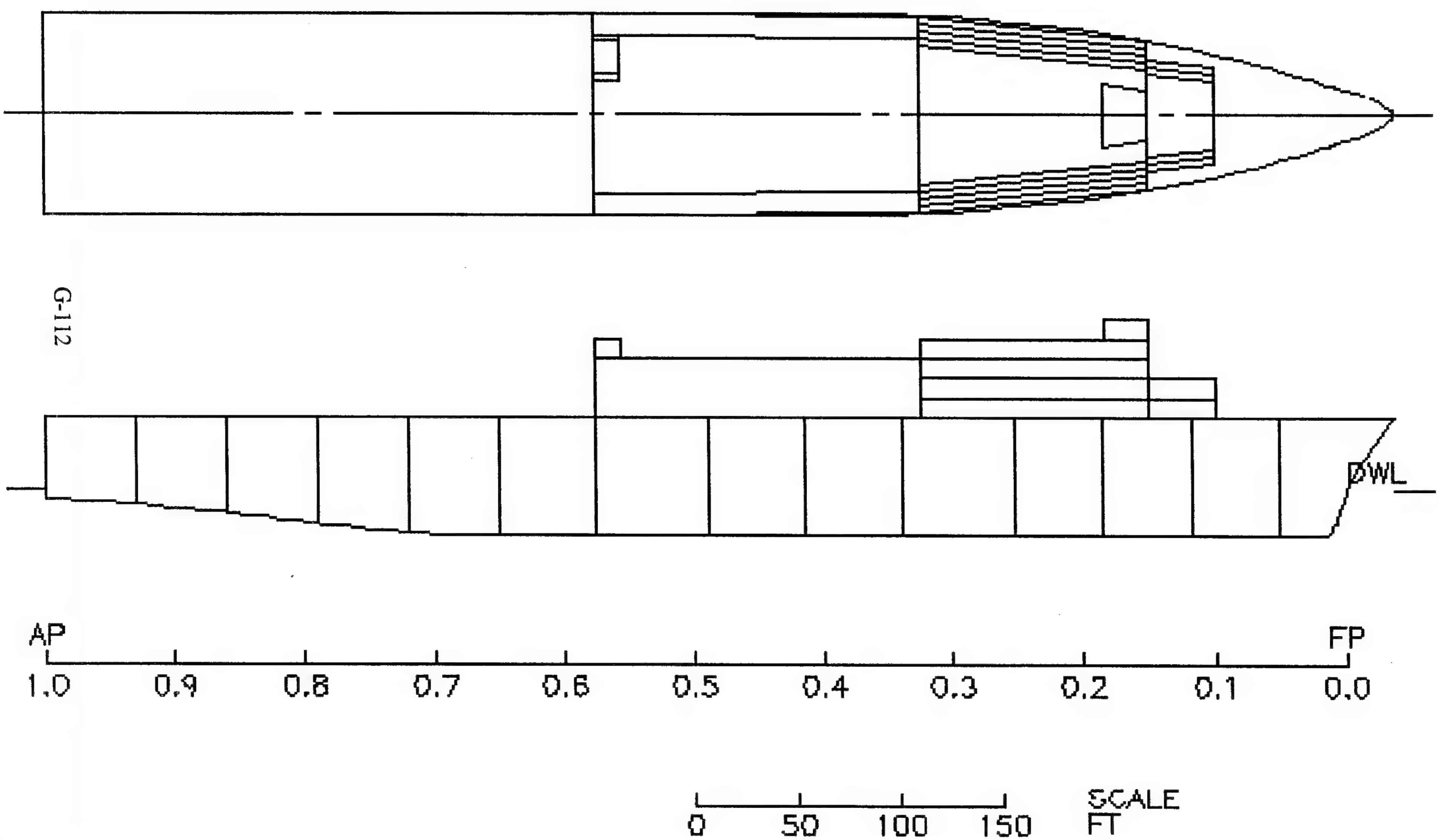


ASSET/MONOLA VERSION 1.0 - HULL SUBDIV MODULE - 1/20/94 08.22.02.
GRAPHIC DISPLAY NO.23 - SECTION AT 585.9 - TBKHD # 13

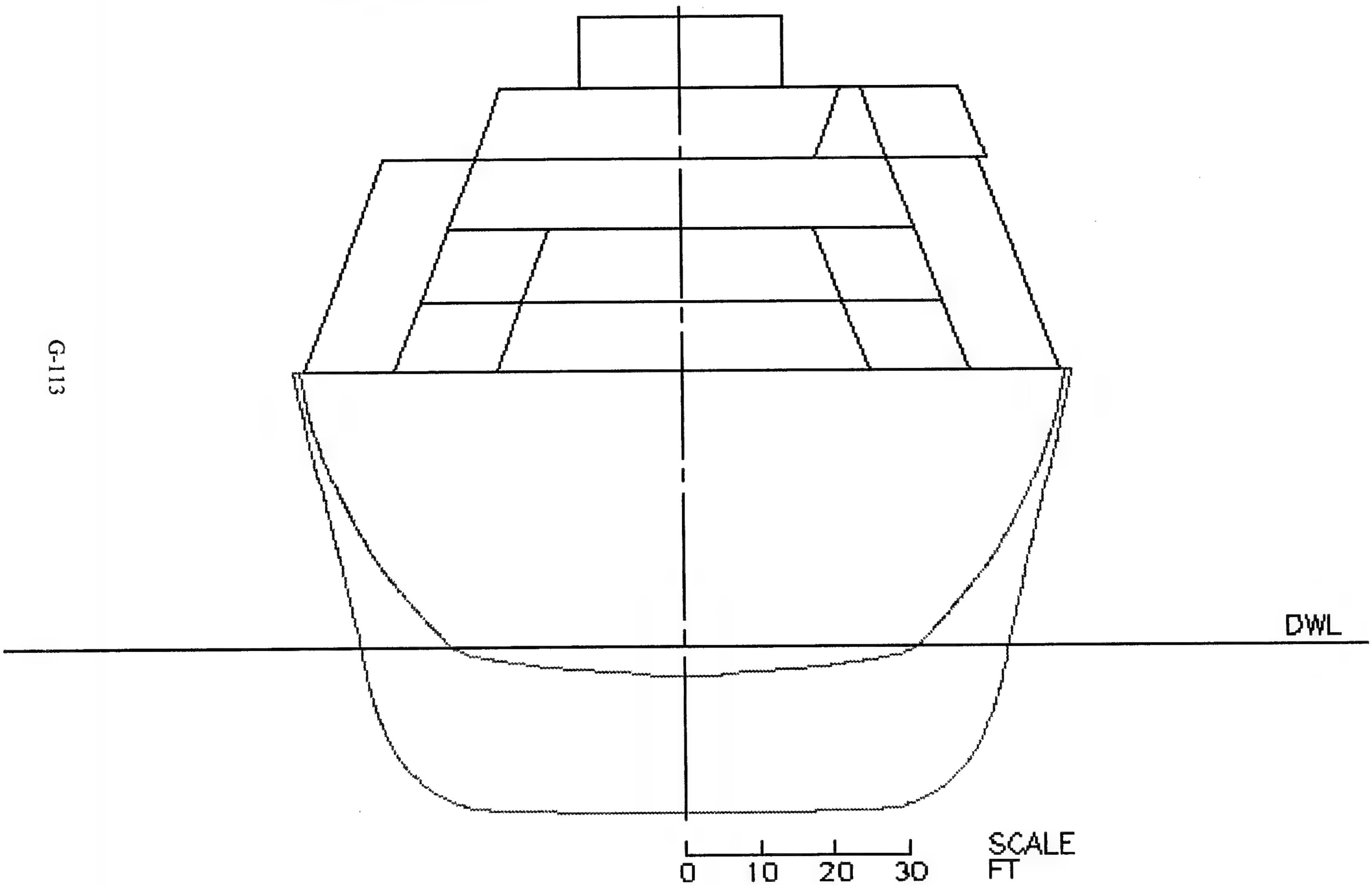


I)

ASSET/MONOLA VERSION 1.0 - DECKHOUSE MODULE - 1/20/94 09.34.52.
GRAPHIC DISPLAY NO. 1 - DECKHOUSE PROFILE AND PLAN VIEWS

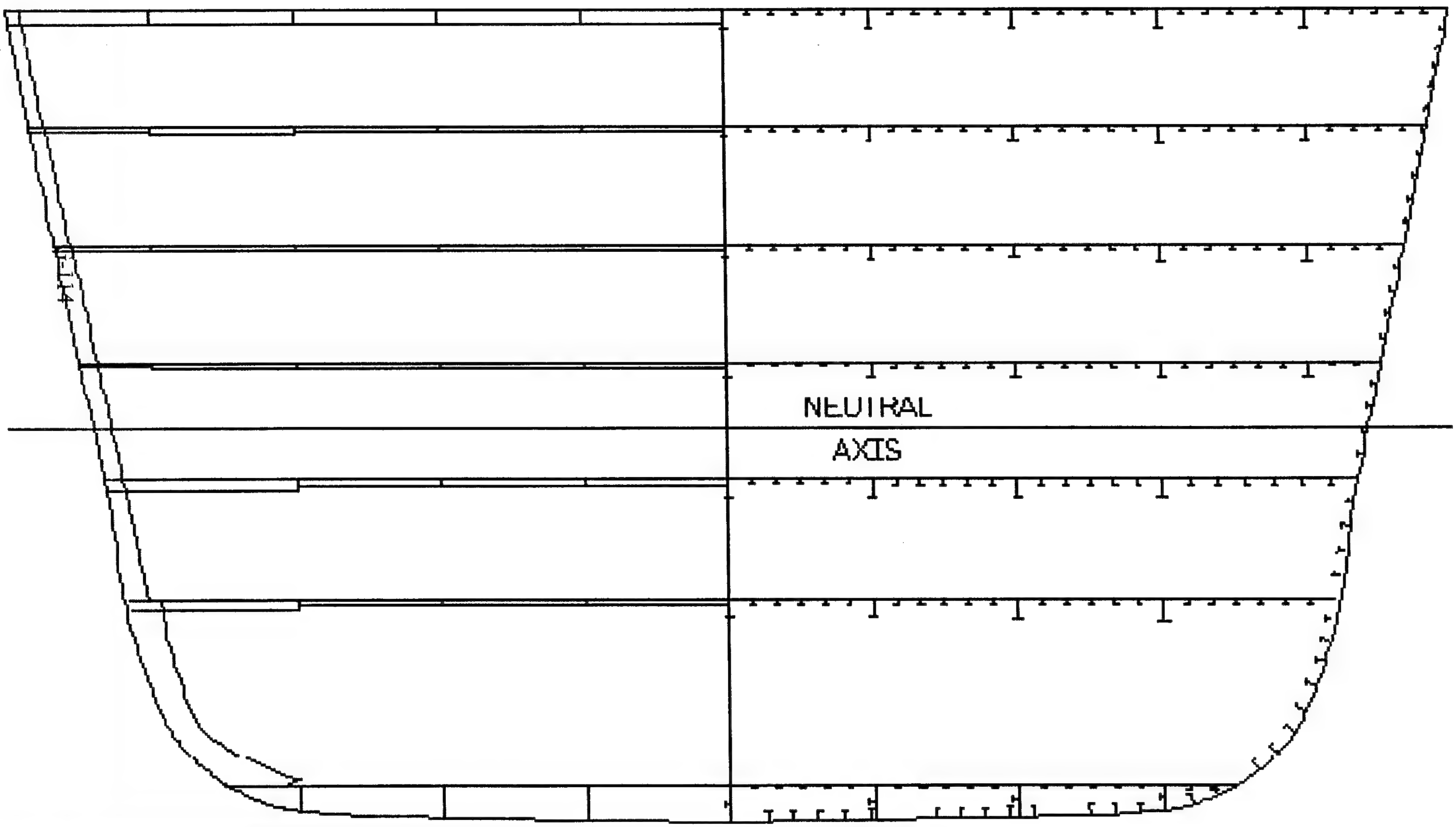


ASSET/MONOLA VERSION 1.0 - DECKHOUSE MODULE - 1/20/94 09.34.52.
GRAPHIC DISPLAY NO. 2 - DECKHOUSE END VIEW

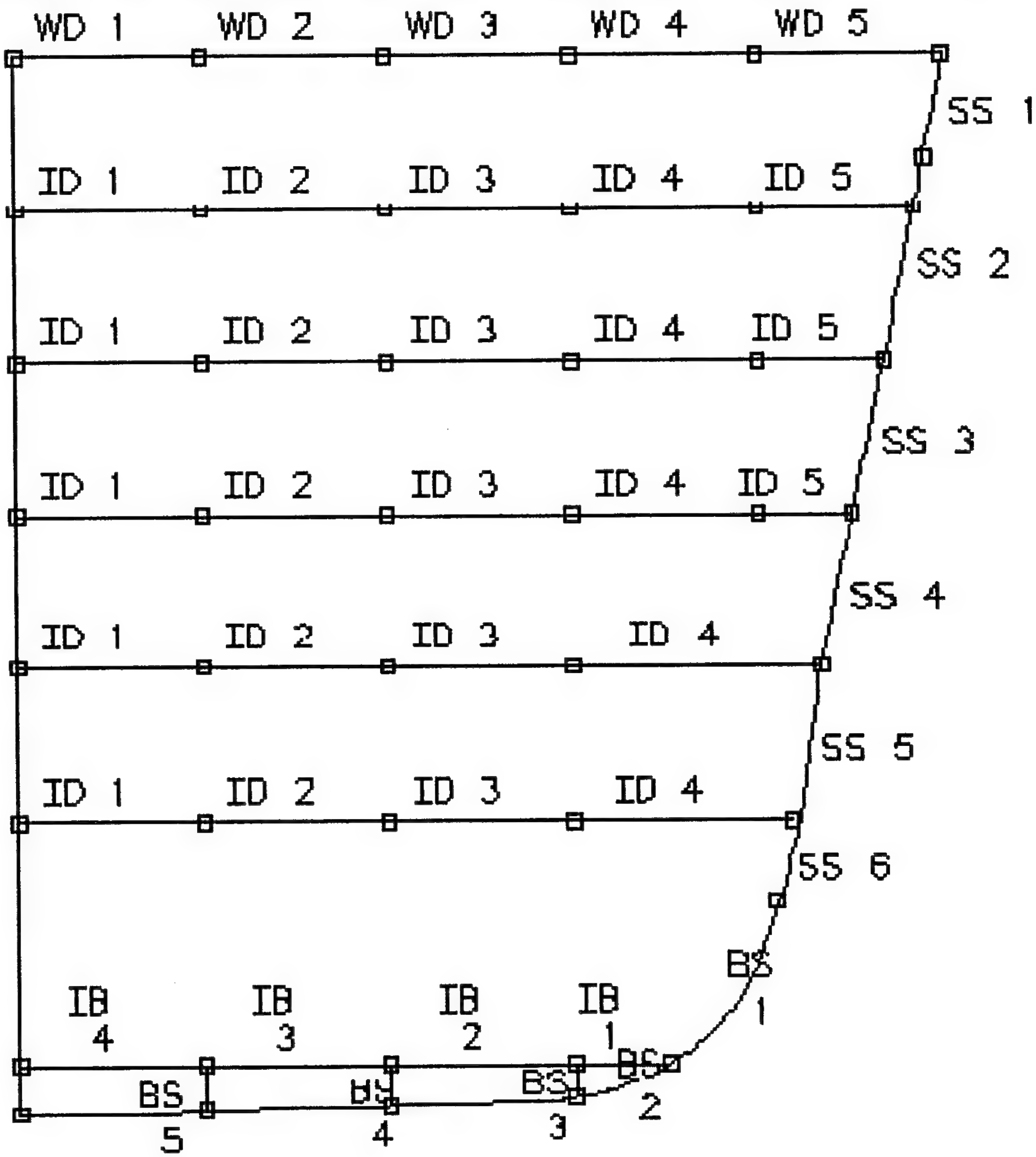


D

ASSET/MONOLA VERSION 1.0 - HULL STRUCT MODULE - 1/20/94 09.40.33.
GRAPHIC DISPLAY NO. 1 - MIDSHIP SECTION

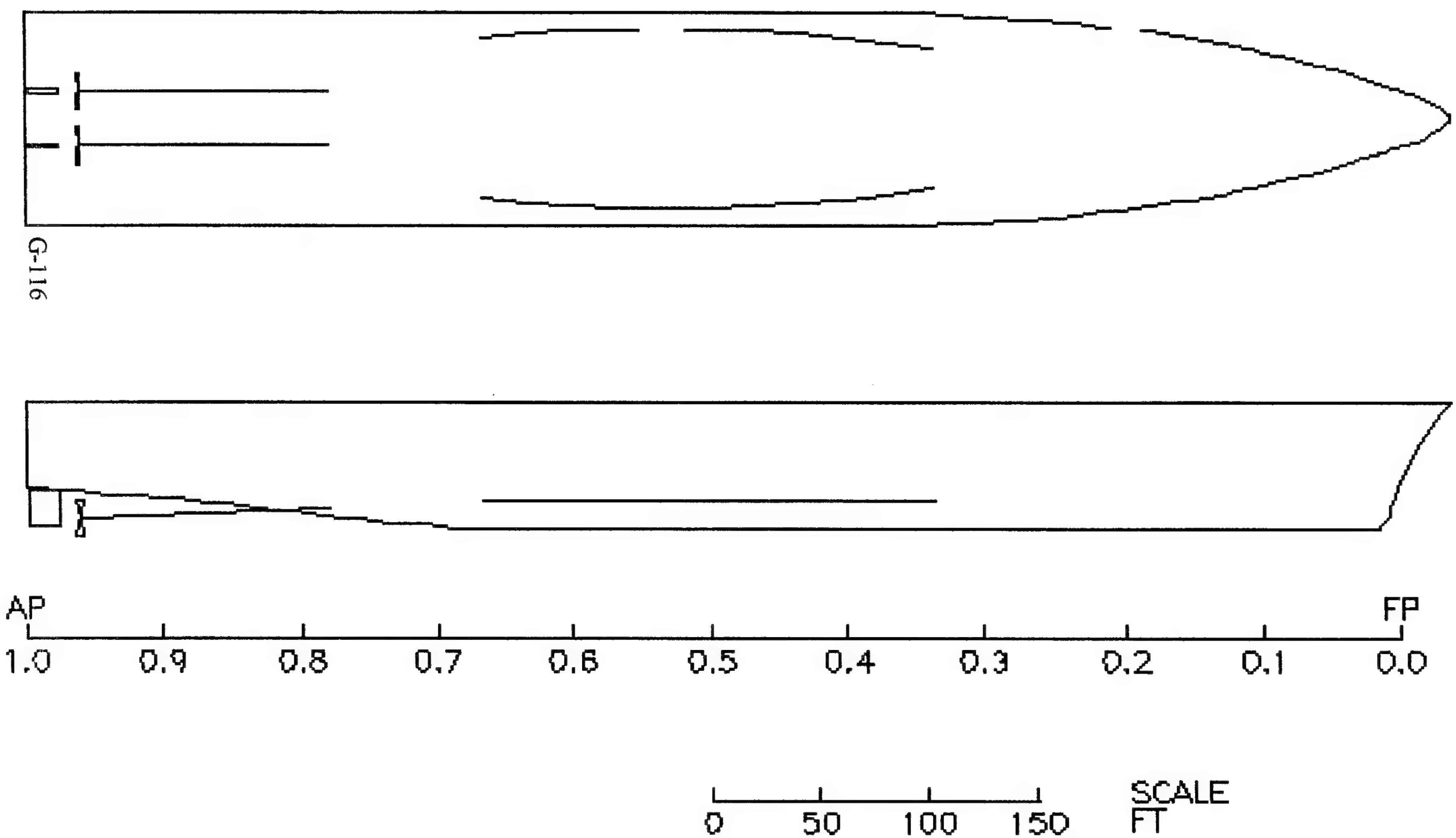


ASSET/MONOLA VERSION 1.0 - HULL STRUCT MODULE - 1/20/94 09.40.33.
GRAPHIC DISPLAY NO. 2 - SEGMENT NODE POINTS

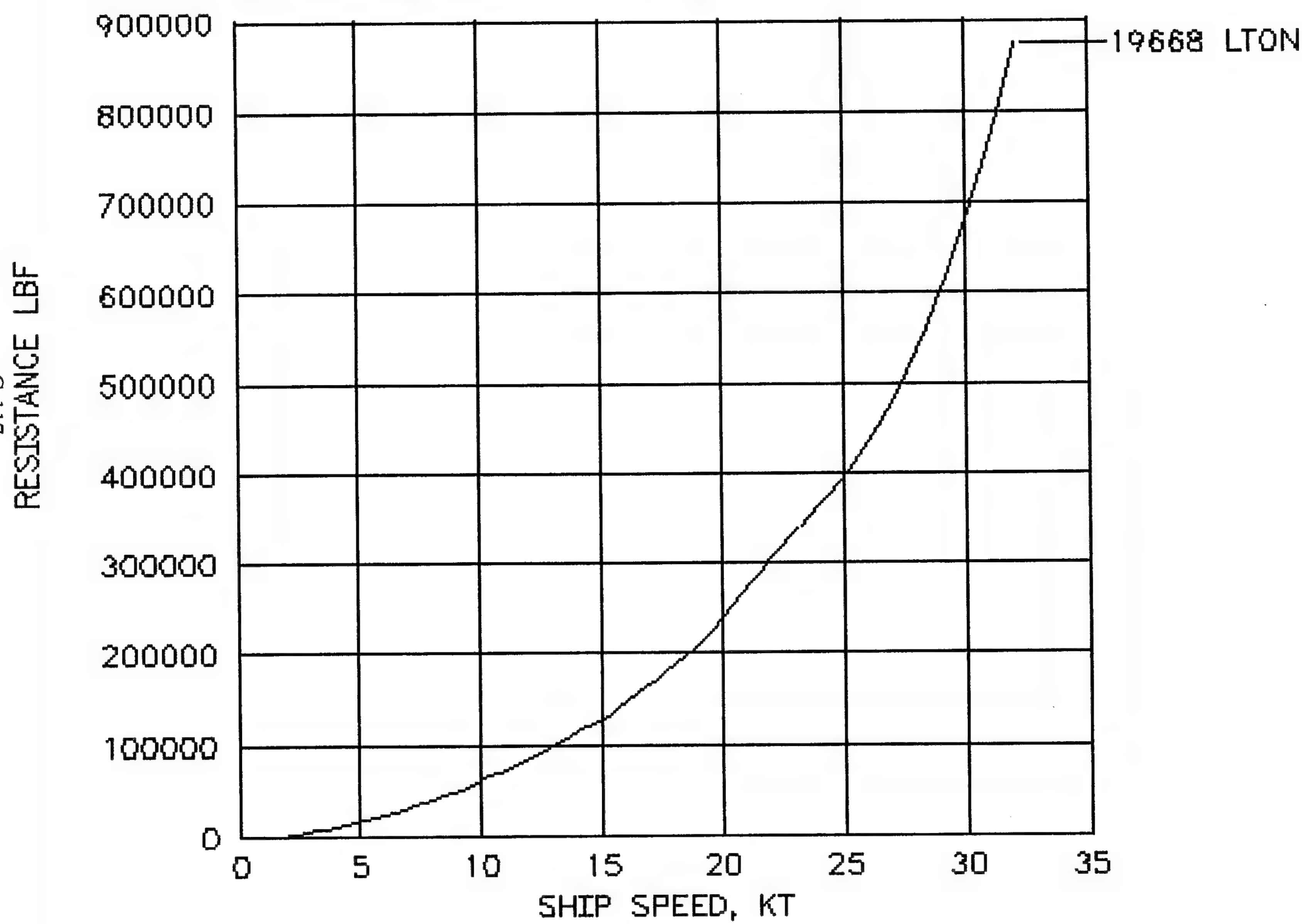


I)

ASSET/MONOLA VERSION 1.0 - APPENDAGE MODULE - 1/20/94 09.47.39.
GRAPHIC DISPLAY NO. 1 - HULL PROFILE AND PLAN VIEW WITH APPENDAGES

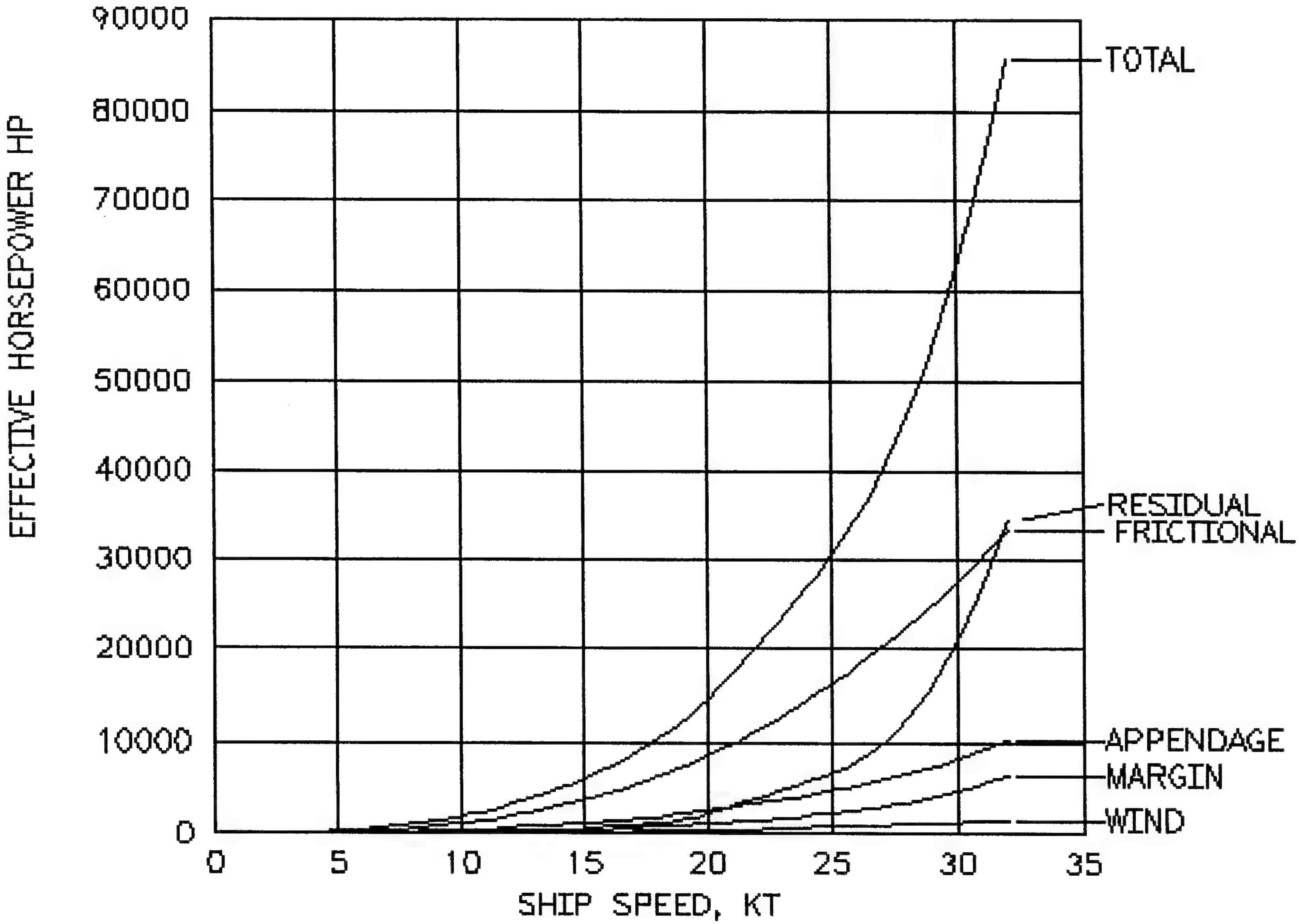


ASSET/MONOLA VERSION 1.0 - RESISTANCE MODULE - 1/20/94 09.52.11.
GRAPHIC DISPLAY NO. 1 - RESISTANCE VERSUS SPEED



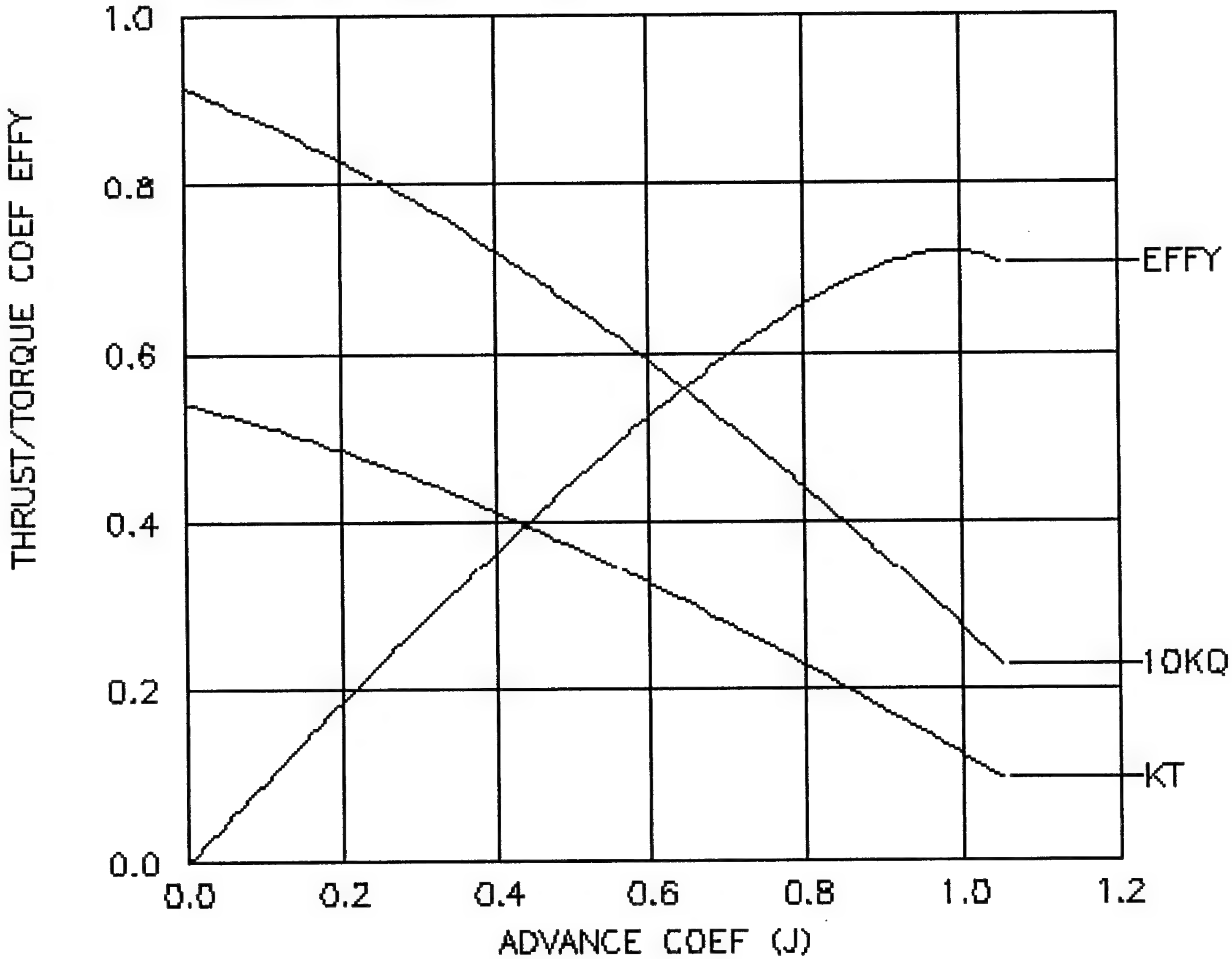
I)

ASSET/MONOLA VERSION 1.0 - RESISTANCE MODULE - 1/20/94 09.55.20.
GRAPHIC DISPLAY NO. 2 - EHP VERSUS SPEED



DISPLACEMENT = 19668 LTON

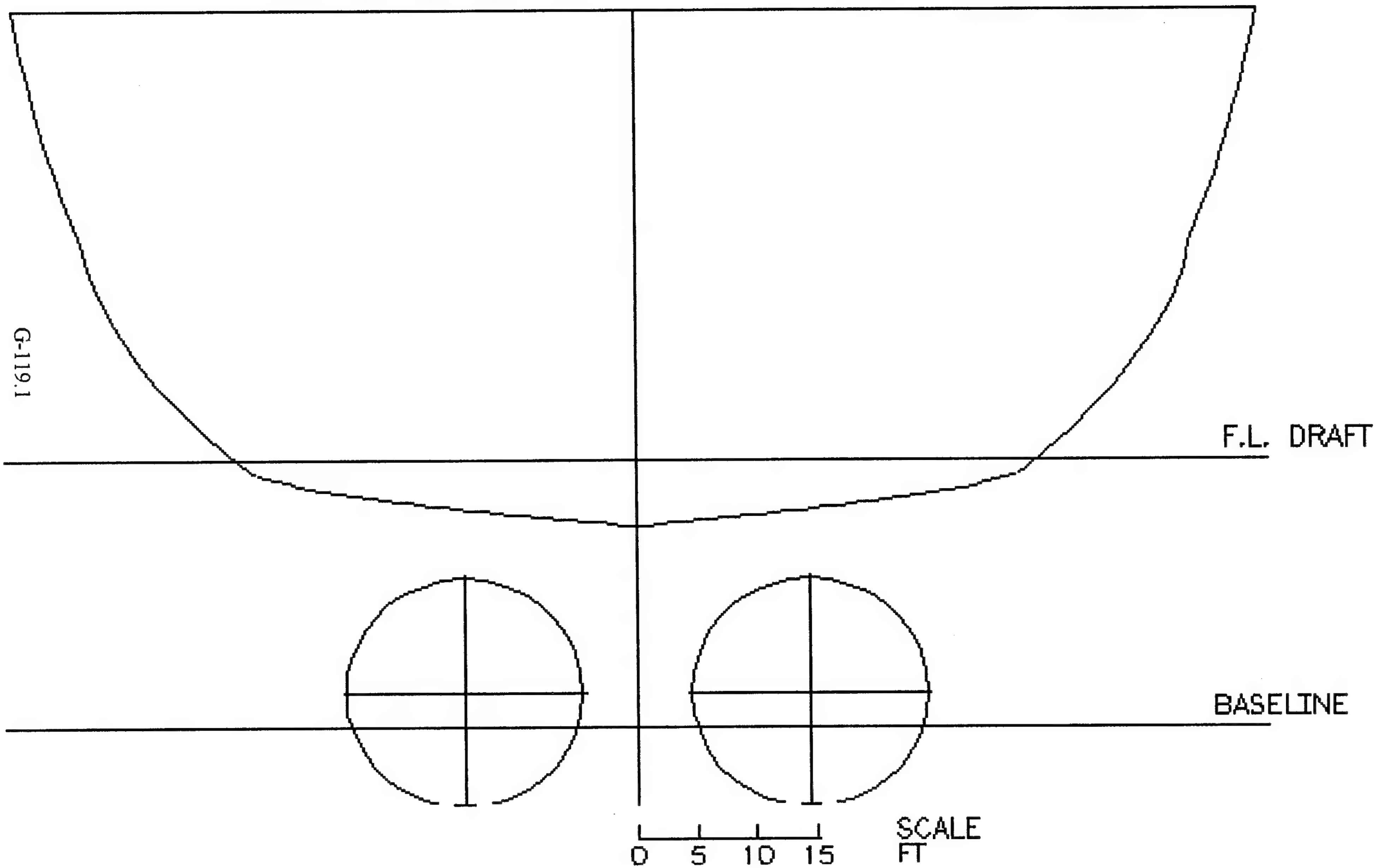
ASSET/MONOLA VERSION 1.0 - PROPELLER MODULE - 1/20/94 10.27.05.
GRAPHIC DISPLAY NO. 1 - OPEN WATER DIAGRAM



PROP SERIES IND-TROOST

PROP ID IND-

ASSET/MONOLA VERSION 1.0 - PROPELLER MODULE - 1/20/94 10.20.23.
GRAPHIC DISPLAY NO. 2 - TRANSVERSE SECTION



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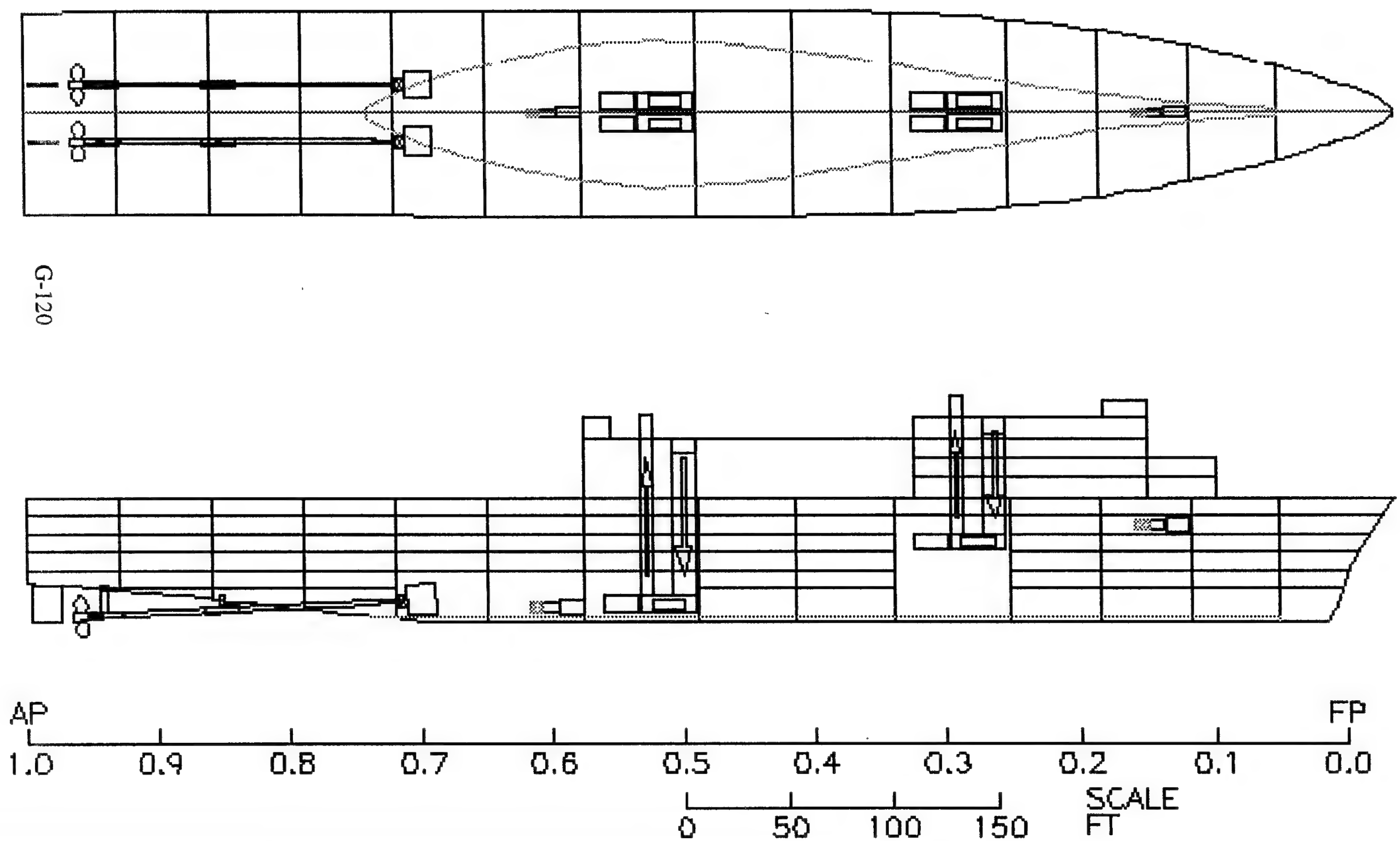
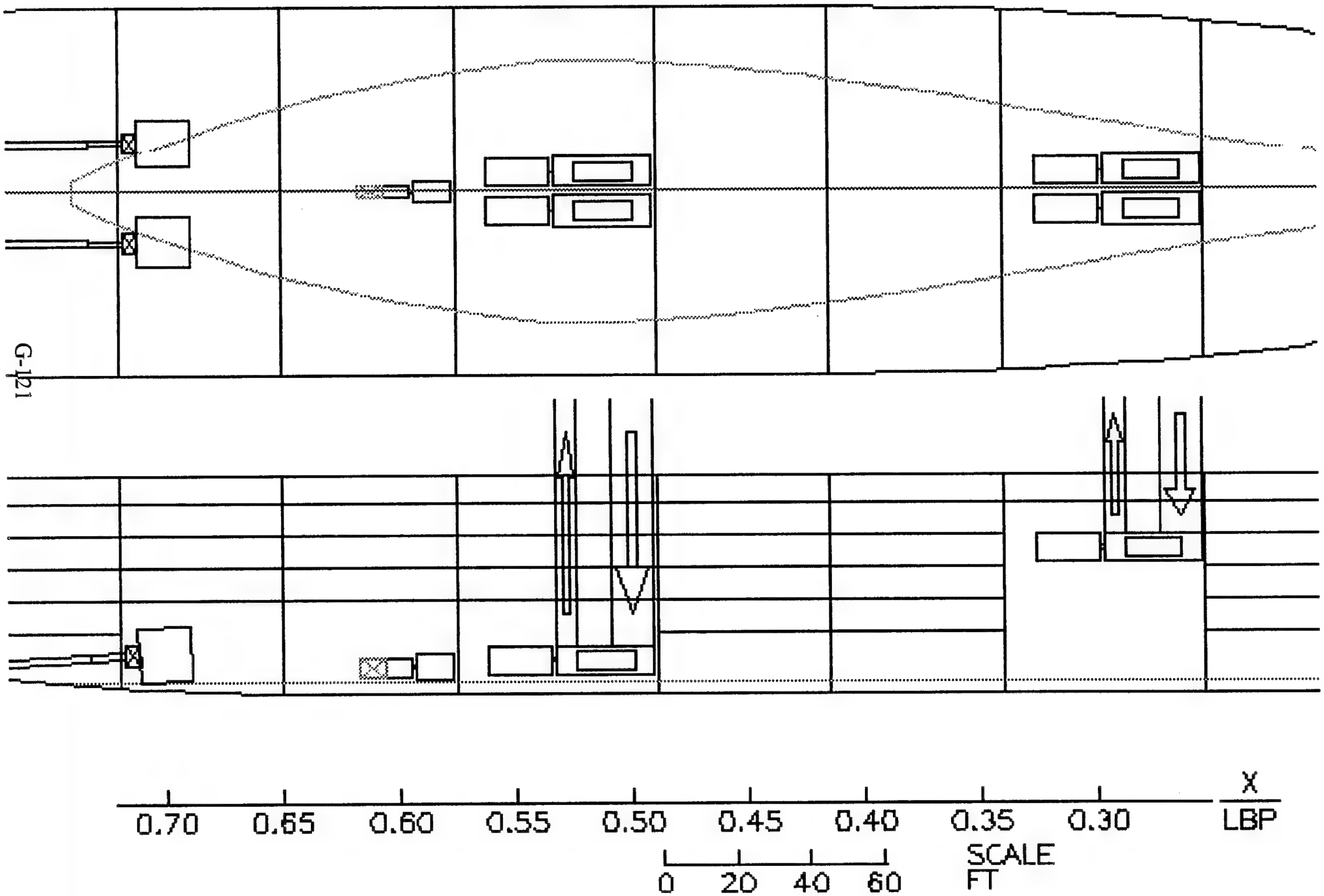
ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 1 - SHIP MACHINERY LAYOUT

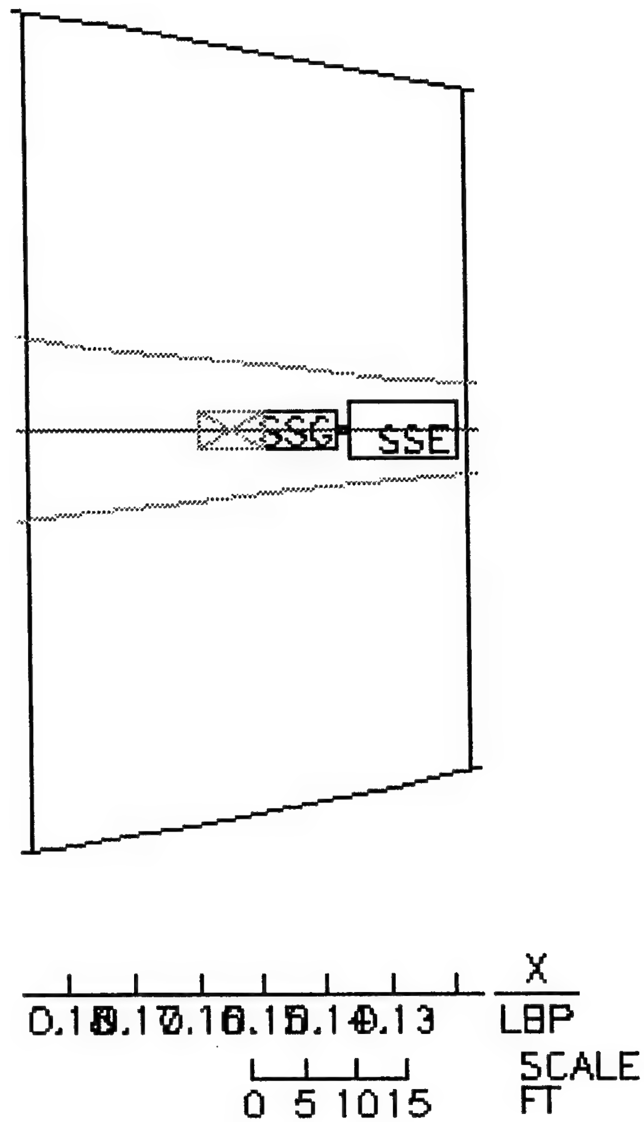


ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 2 - MACHINERY BOX

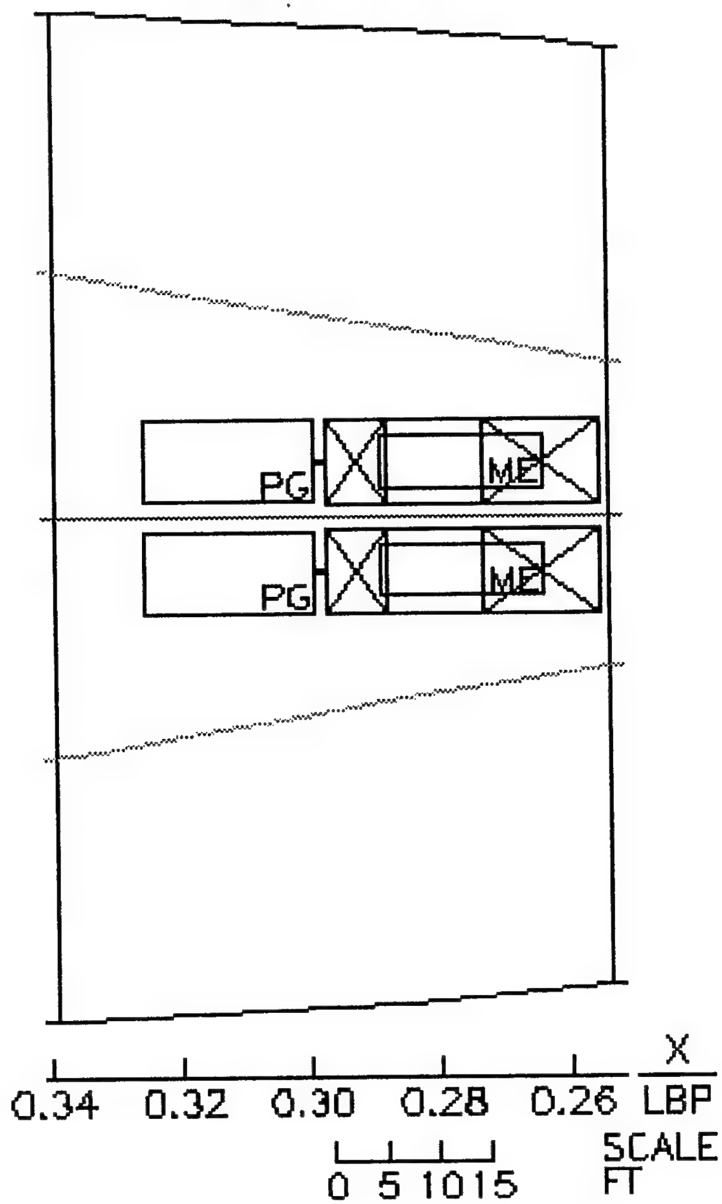


I)

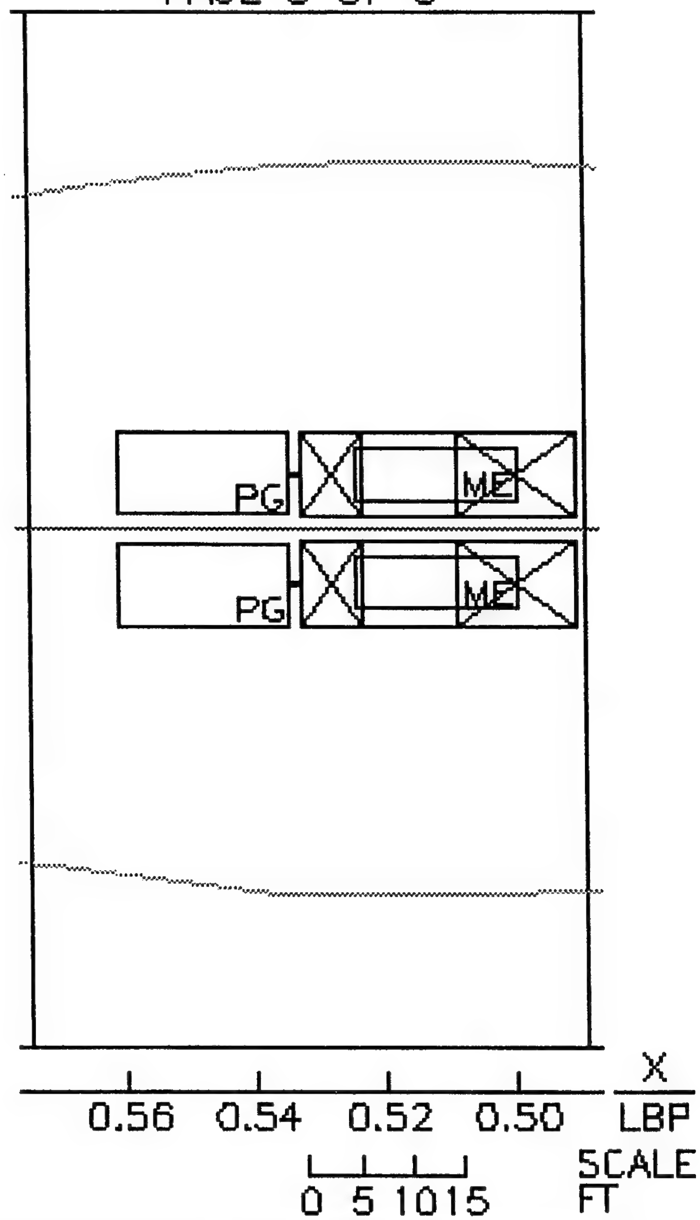
ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 3 - MR PLAN VIEWS (OMR1)
PAGE 1 OF 6



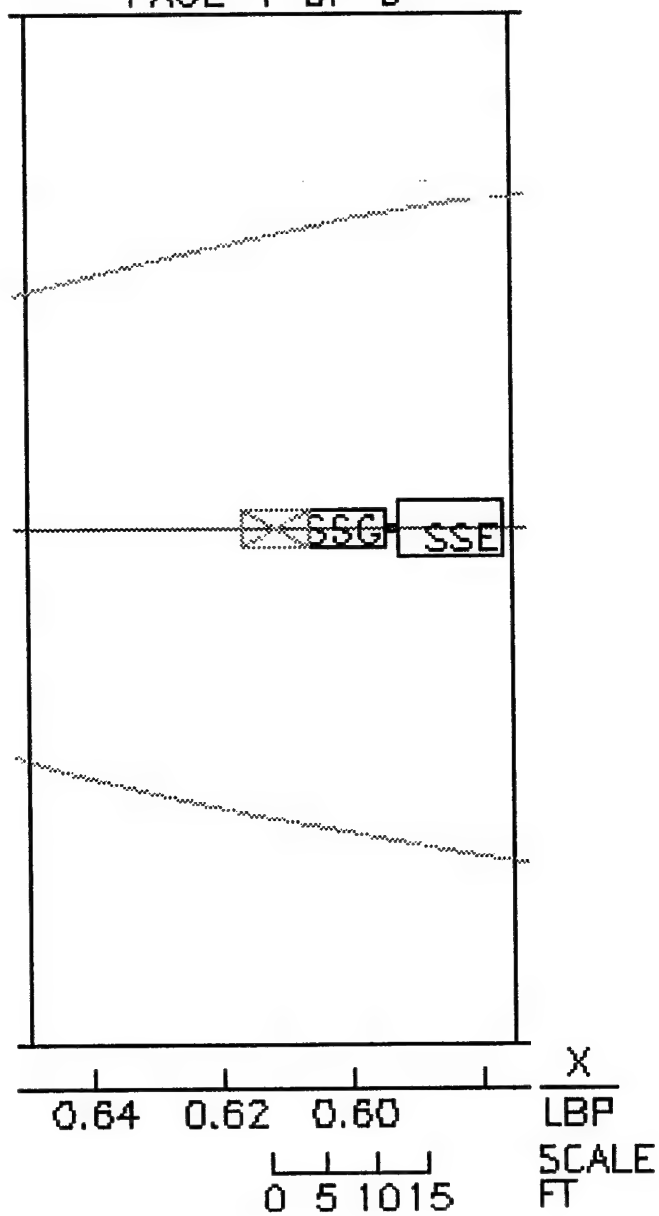
ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 3 - MR PLAN VIEWS <MMR1>
PAGE 2 OF 6



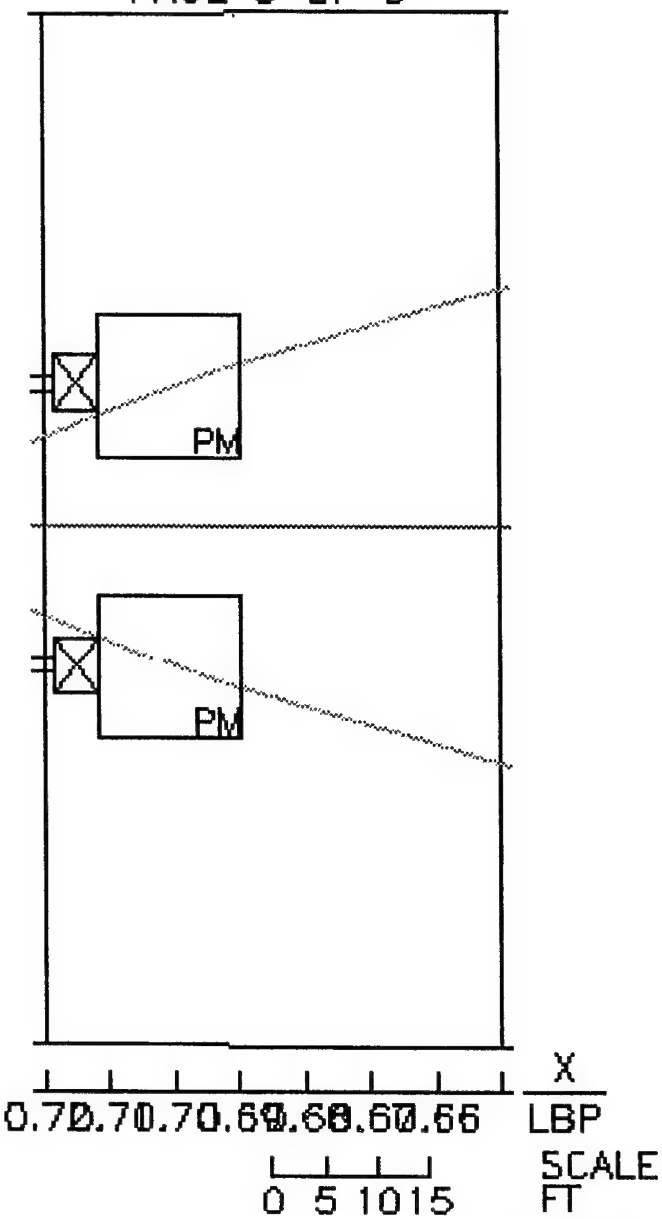
ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 3 - MR PLAN VIEWS (MMR2)
PAGE 3 OF 6



ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 3 - MR PLAN VIEWS (AMR1)
PAGE 4 OF 6

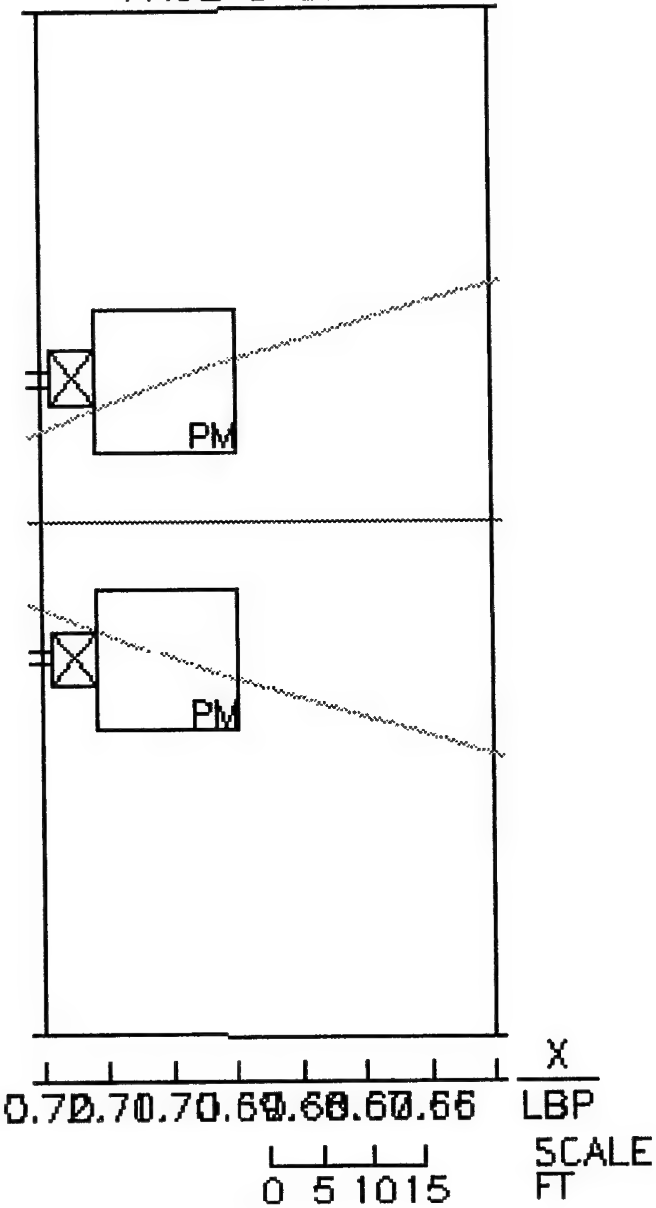


ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 3 - MR PLAN VIEWS (AMR2)
PAGE 5 OF 6



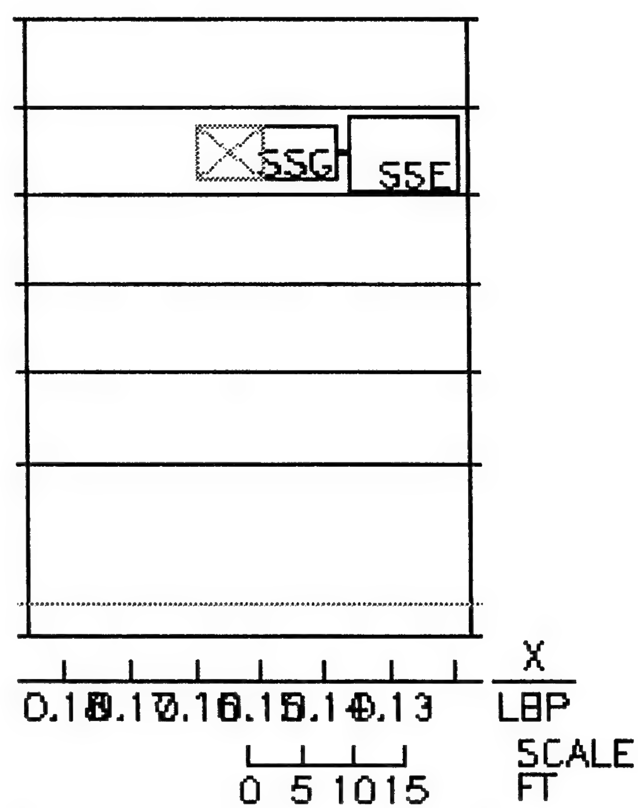
I)

ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 3 - MR PLAN VIEWS (AMR3)
PAGE 6 OF 6

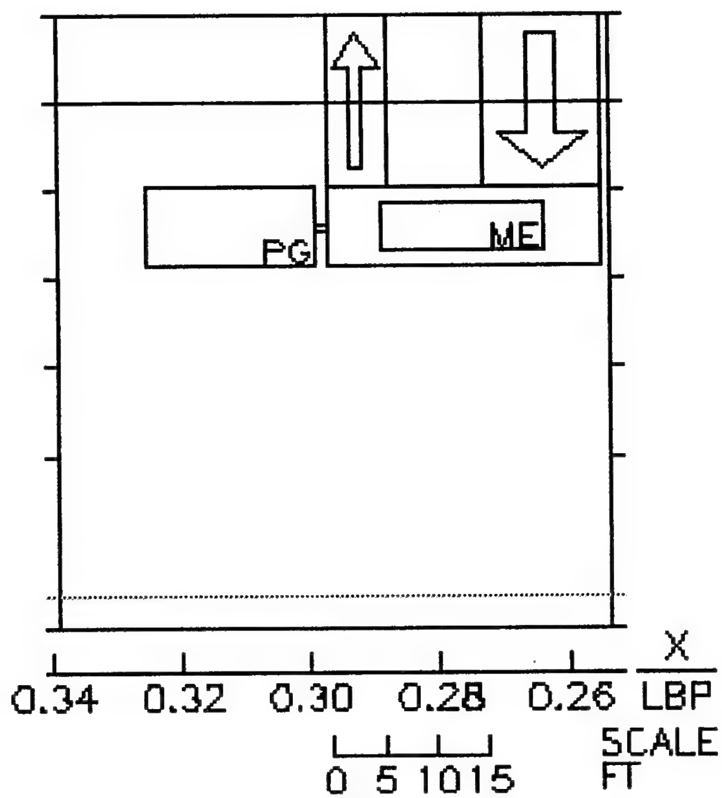


I)

ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 4 - MR PROFILE VIEWS (OMR1)
PAGE 1 OF 6

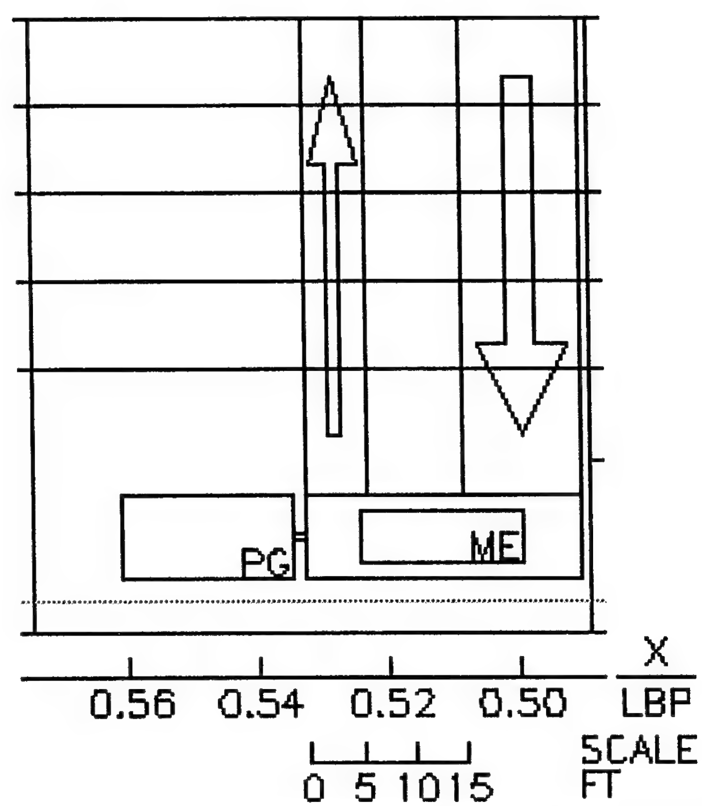


ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 4 - MR PROFILE VIEWS (MMR1)
PAGE 2 OF 6

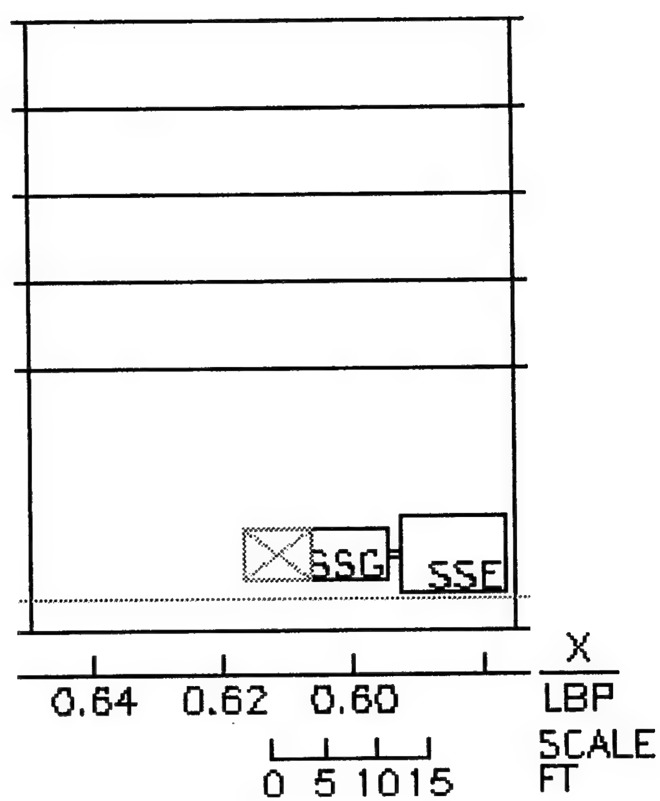


I)

ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 4 - MR PROFILE VIEWS (MMR2)
PAGE 3 OF 6



ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 4 - MR PROFILE VIEWS (AMR1)
PAGE 4 OF 6



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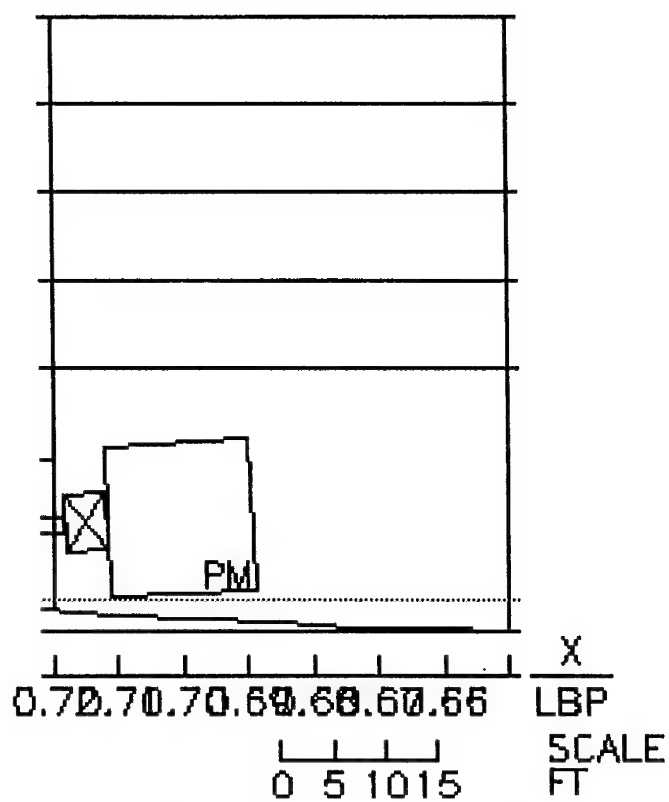
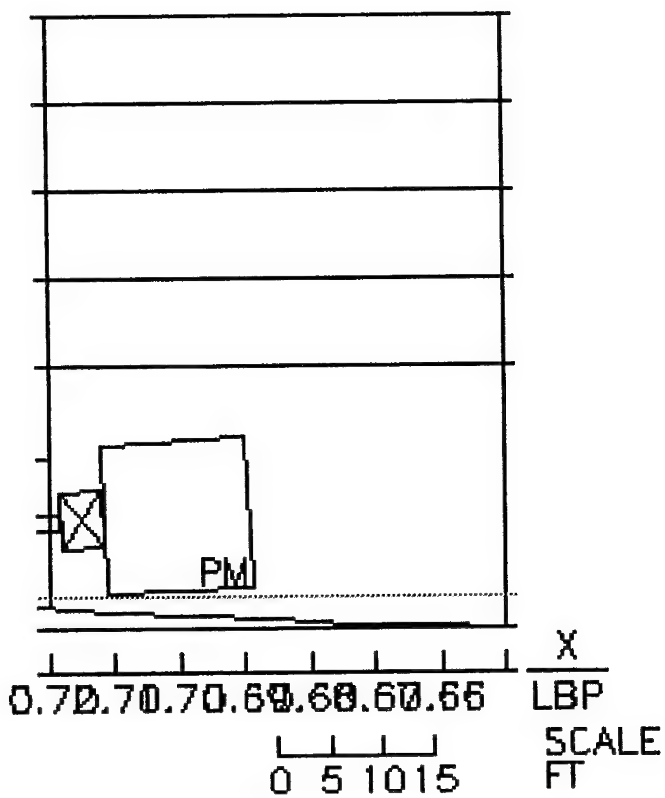
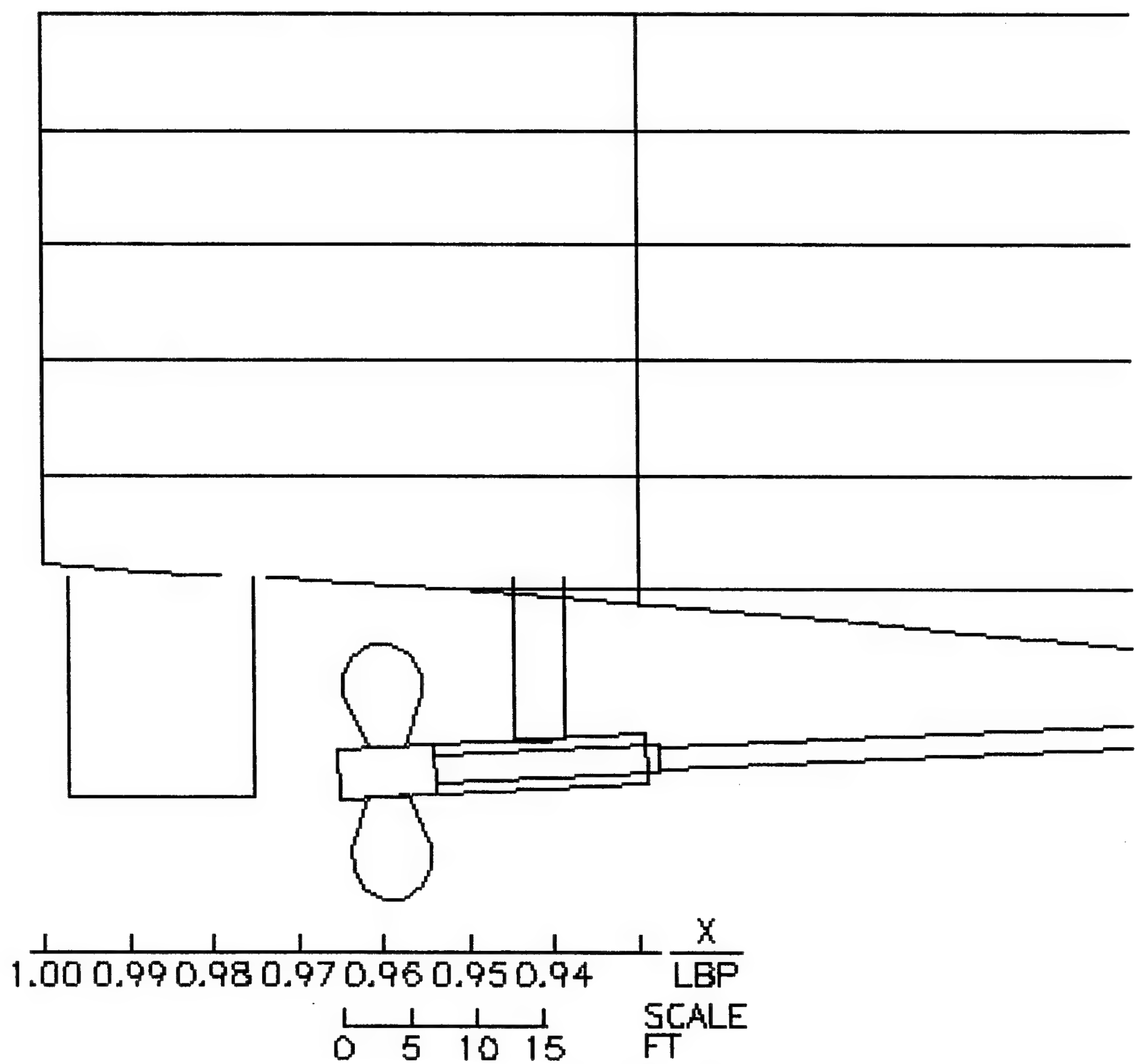
ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 4 - MR PROFILE VIEWS (AMR2)
PAGE 5 OF 6



ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 4 - MR PROFILE VIEWS (AMR3)
PAGE 6 OF 6



ASSET/MONOLA VERSION 1.0 - MACHINERY MODULE - 1/20/94 13.48.31.
GRAPHIC DISPLAY NO. 5 - PROPULSION APPENDAGES PROFILE VIEW



APPENDIX H

TABULATED GHS STABILITY DATA FOR MEDIUM SIZED CMD

Part: HULL   Component: HULL.C   Side: CL   Effectiveness: 1.000

Origin Depth: 23.200   Trim: zero   Heel: zero

HULL.C COMPONENT FORM

Volume = 692780 Cubic Ft   LCB = 324.30a   TCB = 0.00   VCB = 13.73

B L O C K   D I M E N S I O N S

Length = 630.39   Breadth = 90.41   Depth (deepest point) = 23.25
Length/Breadth = 6.97   Length/Depth = 27.12   Breadth/Depth = 3.889
Breadth - Length/10 = 27.37 Ft   Block Coefficient = 0.523
Displacement-Length Ratio = 79.0   Length-Volume Ratio = 7.13

W A T E R P L A N E

Area = 44643.7 Square Ft   LCA = 361.90   TCA = 0.00
Moments of Inertia: IL = 1.064E+09 Ft^4   IT = 2.454E+07 Ft^4
Length = 630.39   Breadth = 90.41   Waterplane Coefficient = 0.783

M A X I M U M   S E C T I O N

Area = 1908.6 Square Ft   Coefficient = 0.911

P R I S M A T I C   C O E F F I C I E N T S

Cp = 0.576   Cvp = 0.668

ALL OF SHIP 'CMD03' HAS BEEN USED.

ASSET/MONOLA VERSION 1.0 - WEIGHT MODULE - 1/07/94 10.33.31.

PRINTED REPORT NO. 1 - SUMMARY

SWBS	GROUP		WEIGHT LTON	WEIGHT PER CENT	LCG FT		VCG FT
100	HULL STRUCTURE		6764.7	34.4	308.53		43.44
200	PROPULSION PLANT		1058.4	5.4	366.77		26.68
300	ELECTRIC PLANT		970.8	4.9	316.76		30.24
400	COMMAND + SURVEILLANCE		169.8	0.9	271.04		63.40
500	AUXILIARY SYSTEMS		1008.8	5.1	330.81		40.97
600	OUTFIT + FURNISHINGS		1141.5	5.8	270.00		58.13
700	ARMAMENT		1134.0	5.8	392.44		44.05
	LIGHT SHIP		12248.1	62.3	319.70		42.44
M21	PD MARGIN	(WT = 2.4%)	+ 294.0			(KG = 2.4%)	+ 1.02
M22	CD MARGIN	(WT = 2.4%)	+ 301.0			(KG = 2.4%)	+ 1.04
M11	D & B MARGIN	(WT = 5.3%)	+ 680.7			(KG = 5.3%)	+ 2.36
M23	CON MOD MARGIN	(WT = 1.4%)	+ 179.8			(KG = 1.4%)	+ .62
M24	GFM MARGIN	(WT = .6%)	+ 77.1			(KG = .6%)	+ .27
	LIGHT SHIP WITH MARGINS		13780.6	70.1	319.70		47.75
F00	FULL LOADS		5887.7	29.9	343.22		21.75
F10	SHIPS FORCE + EFFECTS		46.2		175.22		91.89
F20	MISSION RELATED EXPENDABLES		391.5		233.45		11.26
F30	SHIPS STORES		60.5		128.52		50.41
F40	FUELS + LUBRICANTS		3548.7		334.91		11.43
F50	LIQUIDS + GASES (NON FUEL)		77.5		194.67		16.31
F60	CARGO		1763.3		402.62		42.27
	FULL LOAD WT		19668.3	100.0	326.75		39.97

ALL OF SHIP 'CMD03' HAS BEEN USED.

ASSET/MONOLA VERSION 1.0 - DESIGN SUMMARY - 1/07/94 10.41.11.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PRINCIPAL CHARACTERISTICS - FT	
LBP	630.0
LOA	653.8
BEAM, DWL	90.0
BEAM, WEATHER DECK	99.5
DEPTH @ STA 10	62.0
DRAFT TO KEEL DWL	23.2
DRAFT TO KEEL LWL	23.2
FREEBOARD @ STA 3	42.8
GMT	9.0
CP	0.570
CX	0.910

SPEED(KT): MAX= 30.6 SUST= 29.3
ENDURANCE: 6000.0 NM AT 16.0 KTS

TRANSMISSION TYPE: ELECT
MAIN ENG: 4 GT @ 26250.0 HP

SHAFT POWER/SHAFT: 48930.0 HP
PROPELLERS: 2 - FP - 17.5 FT DIA

SEP GEN: 2 F DIESEL @ 2000.0 KW

24 HR LOAD 4346.6
MAX MARG ELECT LOAD 12874.5

	OFF	CPO	ENL	TOTAL
MANNING	42	27	340	409
ACCOM	43	28	351	422

WEIGHT SUMMARY - LTON	
GROUP 1 - HULL STRUCTURE	6764.7
GROUP 2 - PROP PLANT	1058.4
GROUP 3 - ELECT PLANT	970.8
GROUP 4 - COMM + SURVEIL	169.8
GROUP 5 - AUX SYSTEMS	1008.8
GROUP 6 - OUTFIT + FURN	1141.5
GROUP 7 - ARMAMENT	1134.0
SUM GROUPS 1-7	12248.1
DESIGN MARGIN	1532.5
LIGHTSHIP WEIGHT	13780.6
LOADS	5887.7
FULL LOAD DISPLACEMENT	19668.3
FULL LOAD KG: FT	40.0

MILITARY PAYLOAD WT - LTON 1929.0
USABLE FUEL WT - LTON 1775.1

AREA SUMMARY - FT2	
HULL AREA -	142335.8
SUPERSTRUCTURE AREA -	80230.2
TOTAL AREA	222566.0

VOLUME SUMMARY - FT3	
HULL VOLUME -	2684135.0
SUPERSTRUCTURE VOLUME -	802301.8
TOTAL VOLUME	3486436.8

HYDROSTATIC PROPERTIES
No Trim, No Heel, VCG = 39.97

LCF Draft	Displacement Weight(LT)	Buoyancy-Ctr. LCB	VCB	Weight/ Inch	LCF	Moment/ Deg trim	KML	KMT
2.000	737.62	282.59a	1.16	39.85	286.55a	66857	5232.6	165.53
4.000	1,795.90	286.00a	2.26	47.86	290.07a	93001	3006.7	99.95
6.000	3,022.71	288.42a	3.39	54.35	293.93a	118579	2287.4	77.04
8.000	4,401.09	290.85a	4.53	60.43	298.41a	146344	1945.0	65.80
10.000	5,921.97	293.50a	5.68	66.20	303.81a	177214	1754.4	58.88
12.000	7,579.91	296.47a	6.85	71.90	310.33a	212525	1646.3	54.42
14.000	9,378.91	299.91a	8.04	77.99	318.32a	255460	1600.4	51.89
16.000	11,332.54	304.00a	9.24	84.80	328.79a	311027	1612.3	50.64
18.000	13,462.97	309.03a	10.47	92.87	342.96a	388750	1694.2	50.42
20.000	15,792.74	315.15a	11.73	100.75	356.55a	470599	1747.1	50.87
22.000	18,268.41	321.18a	12.99	104.94	361.48a	510065	1639.5	50.20
24.000	20,813.58	326.15a	14.22	107.00	361.83a	527895	1493.0	48.45
26.000	23,401.89	330.08a	15.41	108.69	361.41a	542183	1367.3	47.04
28.000	26,030.81	333.22a	16.58	110.38	360.98a	556549	1264.9	46.10
30.000	28,700.56	335.77a	17.74	112.12	360.33a	571845	1181.4	45.53
32.000	31,412.91	337.86a	18.88	113.91	359.47a	587984	1112.3	45.23
34.000	34,168.03	339.56a	20.02	115.68	358.58a	604086	1052.8	45.15
36.000	36,965.93	340.97a	21.16	117.49	357.61a	620661	1001.9	45.25
38.000	39,808.39	342.11a	22.29	119.38	356.34a	638636	959.1	45.50
40.000	42,696.12	343.03a	23.42	121.26	355.07a	656617	921.0	45.86
42.000	45,629.14	343.76a	24.55	123.15	353.83a	674662	887.0	46.31
44.000	48,607.74	344.33a	25.68	125.07	352.33a	693727	857.6	46.84
46.000	51,631.28	344.76a	26.82	126.92	351.05a	710914	828.8	47.44
48.000	54,700.44	345.08a	27.95	128.85	349.59a	730173	804.7	48.10
50.000	57,816.00	345.28a	29.08	130.78	348.05a	749866	783.0	48.81
52.000	60,978.23	345.38a	30.22	132.73	346.44a	770183	763.6	49.56
54.000	64,187.13	345.39a	31.36	134.67	344.78a	790995	746.0	50.34
56.000	67,442.59	345.32a	32.50	136.62	343.07a	812405	730.1	51.16
58.000	70,744.85	345.17a	33.65	138.59	341.27a	834303	715.6	52.00
60.000	74,094.16	344.96a	34.79	140.56	339.50a	856433	702.2	52.88

Distances in FEET.-------Specific Gravity = 1.025.-----------Moment in Ft-LT.
Draft is from Baseline.

CURVES OF FORM
HULL.C Component of Part HULL

Trim: zero   Heel: zero

Ref Pt Depth	Volume (Cu Ft)	Block Coef	Displ/ Length	WaterPl Coef	MaxSect Coef	PrismaticCoefs Long	Vert
2.00	25822	0.400	8.3	0.530	0.782	0.523	0.754
4.00	62869	0.428	17.2	0.554	0.842	0.515	0.773
6.00	105816	0.442	25.6	0.577	0.863	0.516	0.766
8.00	154069	0.452	33.4	0.599	0.875	0.521	0.754
10.00	207310	0.463	40.5	0.623	0.885	0.525	0.742
12.00	265350	0.470	46.7	0.644	0.894	0.529	0.729
14.00	328327	0.474	51.5	0.664	0.900	0.530	0.713
16.00	396718	0.475	54.8	0.684	0.904	0.529	0.694
18.00	471298	0.474	56.4	0.708	0.907	0.526	0.669
20.00	552856	0.490	63.4	0.753	0.907	0.542	0.652
22.00	639522	0.512	73.1	0.778	0.911	0.564	0.658
24.00	728621	0.530	82.9	0.786	0.911	0.583	0.674
26.00	819230	0.544	92.8	0.790	0.911	0.599	0.689
28.00	911260	0.557	102.7	0.795	0.910	0.614	0.701
30.00	1004720	0.568	112.6	0.800	0.909	0.626	0.710
32.00	1099671	0.577	122.6	0.805	0.907	0.637	0.717
34.00	1196120	0.585	132.7	0.810	0.906	0.647	0.723
36.00	1294066	0.592	142.9	0.815	0.904	0.656	0.727
38.00	1393572	0.599	153.1	0.820	0.903	0.664	0.730
40.00	1494663	0.605	163.4	0.825	0.901	0.672	0.733
42.00	1597339	0.610	173.7	0.831	0.899	0.679	0.734
44.00	1701611	0.615	184.1	0.836	0.897	0.686	0.735
46.00	1807456	0.619	194.4	0.841	0.895	0.692	0.736
48.00	1914898	0.623	204.6	0.845	0.894	0.697	0.736
50.00	2023964	0.626	214.9	0.850	0.892	0.703	0.736
52.00	2134664	0.629	225.2	0.855	0.890	0.708	0.736
54.00	2246998	0.632	235.5	0.860	0.888	0.712	0.735
56.00	2360962	0.634	245.8	0.864	0.886	0.717	0.734
58.00	2476564	0.637	256.2	0.869	0.884	0.721	0.733
60.00	2593814	0.639	266.6	0.873	0.882	0.725	0.732

Distances in FEET.-----Length is true waterline.----------------------

HULL Reference Point: Long.= 0.00 Trans.= 0.00 Vert.= 0.00

Part: HULL Component: HULL.C Side: CL Effectiveness: 1.000
Origin Depth: 23.200 Trim: zero Heel: zero

HULL.C COMPONENT SECTIONS

Section Location	Baseline Depth	Section Area	Section TCtr	Section VCtr	Waterline Width	Waterline Ctr
23.80f	23.20					
...						
0.39f	23.20	0.00	0.00	23.20	0.58	-0.00
0.00	23.20	0.42	0.00	22.87	0.73	-0.00
4.90a	23.20	21.93	0.00	16.45	2.59	-0.00
9.81a	23.20	45.43	0.00	14.85	4.45	0.00
26.14a	23.20	137.57	0.00	14.64	10.84	0.00
42.46a	23.20	233.82	0.00	14.54	17.31	0.00
58.78a	23.20	338.38	0.00	14.47	23.96	0.00
75.11a	23.20	461.50	0.00	14.19	30.70	0.00
91.43a	23.20	585.90	0.00	13.98	37.46	0.00
107.76a	23.20	707.23	0.00	13.85	44.03	0.00
124.09a	23.20	832.03	0.00	13.68	50.39	0.00
140.42a	23.20	959.26	0.00	13.50	56.51	0.00
156.74a	23.20	1083.81	0.00	13.33	62.20	0.00
173.07a	23.20	1206.20	0.00	13.16	67.44	0.00
189.40a	23.20	1324.33	0.00	13.00	72.13	0.00
205.72a	23.20	1437.51	0.00	12.85	76.30	0.00
222.04a	23.20	1542.54	0.00	12.71	79.84	0.00
238.37a	23.20	1638.54	0.00	12.58	82.86	0.00
254.70a	23.20	1722.99	0.00	12.47	85.27	0.00
271.02a	23.20	1794.49	0.00	12.37	87.13	0.00
287.35a	23.20	1849.32	0.00	12.29	88.50	0.00
303.67a	23.20	1888.26	0.00	12.24	89.45	0.00
319.99a	23.20	1907.19	0.00	12.23	90.01	0.00
336.32a	23.20	1908.56	0.00	12.25	90.28	0.00
352.64a	23.20	1888.16	0.00	12.33	90.41	0.00
368.97a	23.20	1843.32	0.00	12.48	90.17	0.00
385.30a	23.20	1774.65	0.00	12.70	89.90	0.00
401.63a	23.20	1700.56	0.00	12.95	89.62	0.00
420.66a	23.20	1585.85	0.00	13.44	89.21	0.00
439.69a	23.20	1452.89	0.00	14.11	88.93	0.00
458.72a	23.20	1304.98	0.00	14.93	88.64	0.00
477.75a	23.20	1152.06	0.00	15.83	88.25	0.00
496.78a	23.20	992.96	0.00	16.78	87.82	0.00
515.81a	23.20	844.66	0.00	17.68	87.06	0.00
534.84a	23.20	704.09	0.00	18.53	85.89	0.00
553.88a	23.20	578.03	0.00	19.30	84.03	0.00
572.91a	23.20	472.59	0.00	19.91	81.09	0.00
591.94a	23.20	376.88	0.00	20.46	77.13	0.00
610.97a	23.20	287.36	0.00	20.92	71.44	0.00
630.00a	23.20	211.50	0.00	21.37	63.70	0.00

Distances in FEET.

HULL.C Component of Part HULL

Trim: zero Heel: zero

Section Location	Reference Point Depth at 2.00	10.00	20.00	30.00	40.00	50.00	60.00
23.80f							
22.62f							0.00
15.64f						0.00	74.80
11.90f						10.87	114.81
9.40f					0.00	49.28	173.59
4.04f				0.00	42.24	131.89	299.98
0.00				14.38	74.01	194.00	395.02
0.77a			0.00	19.87	83.08	207.43	413.51
3.89a		0.00	11.51	41.99	119.67	261.56	488.06
4.90a		2.44	15.25	49.19	131.56	279.16	512.29
8.35a	0.00	8.62	27.77	75.11	173.42	340.16	595.33
9.81a	1.35	11.22	33.04	86.03	191.05	365.84	630.29
26.14a	3.75	33.01	105.21	223.45	403.27	665.54	1028.52
42.46a	5.75	56.65	181.31	365.13	618.31	963.43	1417.14
58.78a	7.10	83.00	264.85	515.88	841.50	1265.59	1802.64
75.11a	10.26	121.44	366.54	685.50	1081.83	1579.49	2191.44
91.43a	14.49	162.31	469.45	856.27	1322.01	1888.70	2568.44
107.76a	19.15	201.26	569.83	1022.14	1552.68	2183.31	2923.76
124.09a	26.13	245.92	674.27	1190.16	1782.94	2472.42	3266.88
140.42a	34.40	294.89	781.84	1358.45	2009.05	2751.65	3592.81
156.74a	43.28	345.44	888.11	1521.15	2224.82	3015.08	3897.03
173.07a	52.64	397.82	993.69	1678.51	2430.25	3262.51	4179.07
189.40a	61.93	450.91	1096.63	1827.86	2621.86	3490.23	4435.47
205.72a	70.97	503.72	1196.30	1968.66	2799.64	3698.55	4666.90
222.04a	79.47	555.04	1289.83	2097.35	2959.72	3883.63	4869.94
238.37a	87.54	603.95	1376.01	2213.15	3100.92	4044.58	5044.10
254.70a	94.58	648.12	1452.46	2313.26	3220.83	4179.00	5187.06
271.02a	100.90	687.18	1517.76	2396.88	3319.59	4288.08	5301.32
287.35a	106.13	718.39	1568.10	2460.54	3393.99	4369.36	5385.47
303.67a	109.59	740.13	1603.89	2505.56	3446.25	4425.88	5443.27
319.99a	110.87	749.69	1620.85	2527.98	3472.67	4454.71	5472.83
336.32a	109.21	747.47	1621.25	2531.19	3478.17	4461.19	5479.49
352.64a	105.43	729.60	1600.68	2511.42	3458.64	4441.74	5460.04
368.97a	96.35	693.27	1556.63	2465.23	3411.32	4393.72	5411.67
385.30a	83.79	640.94	1488.95	2394.87	3338.98	4320.22	5337.57
401.63a	72.62	584.29	1415.95	2318.91	3260.63	4240.58	5257.60
420.66a	45.10	493.97	1303.17	2202.04	3141.18	4119.30	5135.45
439.69a	15.73	388.32	1170.95	2066.83	3003.21	3979.44	4994.62
453.94a	0.00	303.26	1061.39	1954.91	2889.69	3864.62	4879.03
458.72a		274.71	1024.61	1917.33	2851.58	3826.07	4840.22
477.75a		165.85	873.06	1761.56	2692.46	3665.25	4678.29
496.78a		75.28	716.28	1600.28	2528.78	3500.10	4512.03

Section Location	Reference Point Depth at 2.00	10.00	20.00	30.00	40.00	50.00	60.00
515.81a		17.42	571.27	1447.43	2372.55	3342.04	4352.60
530.60a		0.00	466.14	1333.04	2253.82	3221.38	4230.72
534.84a			435.94	1300.19	2219.71	3186.72	4195.72
553.88a			317.86	1163.90	2075.40	3038.53	4045.47
572.91a			224.73	1043.34	1942.75	2900.54	3904.91
591.94a			144.85	924.54	1804.36	2753.86	3755.34
610.97a			81.53	808.16	1666.54	2606.56	3604.64
630.00a			32.56	685.98	1509.60	2436.84	3430.59

Distances in FEET.------Areas in square FEET.-------------------------

HULL Reference Point: Long.= 0.00 Trans.= 0.00 Vert.= 0.00

CROSS CURVES OF STABILITY
Showing righting arms in heel at VCG = 39.97

Trim: zero at zero heel (trim righting arm held at zero)

Displacement LONG TONS	5.00s	10.00s	15.00s	20.00s	25.00s	30.00s
737.62	9.03s	12.07s	12.51s	11.69s	10.17s	8.29s
1,795.90	5.00s	8.21s	9.23s	9.06s	8.20s	6.92s
3,022.71	3.17s	5.77s	7.08s	7.31s	6.84s	5.93s
4,401.09	2.21s	4.16s	5.54s	6.05s	5.87s	5.23s
5,921.97	1.63s	3.15s	4.42s	5.09s	5.13s	4.72s
7,579.91	1.27s	2.51s	3.62s	4.35s	4.54s	4.33s
9,378.91	1.05s	2.12s	3.08s	3.76s	4.07s	4.04s
11,332.54	0.94s	1.89s	2.70s	3.33s	3.72s	3.85s
13,462.97	0.92s	1.75s	2.45s	3.02s	3.46s	3.75s
15,792.74	0.91s	1.65s	2.27s	2.82s	3.31s	3.73s
18,268.41	0.85s	1.54s	2.13s	2.68s	3.22s	3.75s
20,813.58	0.74s	1.41s	2.00s	2.57s	3.16s	3.79s
23,401.89	0.63s	1.27s	1.88s	2.48s	3.12s	3.85s
26,030.81	0.55s	1.15s	1.77s	2.41s	3.11s	3.92s
28,700.56	0.50s	1.05s	1.68s	2.37s	3.12s	4.01s
31,412.91	0.47s	0.99s	1.62s	2.35s	3.16s	4.12s
34,168.03	0.46s	0.98s	1.59s	2.35s	3.23s	4.26s
36,965.93	0.47s	0.99s	1.61s	2.38s	3.31s	4.36s
39,808.39	0.49s	1.03s	1.66s	2.45s	3.42s	4.34s
42,696.12	0.52s	1.09s	1.74s	2.54s	3.54s	4.22s
45,629.14	0.56s	1.16s	1.85s	2.68s	3.57s	4.01s
48,607.74	0.61s	1.25s	1.98s	2.84s	3.49s	3.71s
51,631.28	0.66s	1.36s	2.13s	2.95s	3.33s	3.35s
54,700.44	0.72s	1.47s	2.29s	2.92s	3.07s	2.92s
57,816.00	0.78s	1.59s	2.42s	2.77s	2.72s	2.45s
60,978.23	0.84s	1.72s	2.39s	2.49s	2.29s	1.92s
64,187.13	0.91s	1.82s	2.17s	2.07s	1.76s	1.33s
67,442.59	0.98s	1.72s	1.76s	1.51s	1.13s	0.67s
70,744.85	1.04s	1.32s	1.13s	0.79s	0.38s	-0.08s
74,094.16	0.74s	0.58s	0.26s	-0.13s	-0.53s	-0.94s

LONG TONS	35.00s	40.00s	45.00s	50.00s	55.00s	60.00s
737.62	6.19s	3.95s	1.68s	-0.52s	-2.52s	-4.10s
1,795.90	5.39s	3.73s	2.00s	0.36s	-0.98s	-1.66s
3,022.71	4.74s	3.44s	2.17s	1.07s	0.33s	0.48s
4,401.09	4.32s	3.29s	2.33s	1.65s	1.51s	2.25s
5,921.97	4.05s	3.28s	2.60s	2.24s	2.58s	3.44s
7,579.91	3.88s	3.36s	2.95s	2.90s	3.50s	4.21s
9,378.91	3.81s	3.53s	3.38s	3.62s	4.24s	4.70s
11,332.54	3.82s	3.78s	3.89s	4.36s	4.84s	5.03s
13,462.97	3.92s	4.11s	4.46s	5.02s	5.34s	5.30s
15,792.74	4.10s	4.50s	5.09s	5.60s	5.74s	5.49s
18,268.41	4.30s	4.91s	5.63s	6.04s	5.99s	5.53s
20,813.58	4.49s	5.29s	6.01s	6.25s	6.01s	5.40s
23,401.89	4.68s	5.61s	6.20s	6.25s	5.87s	5.15s
26,030.81	4.87s	5.80s	6.20s	6.09s	5.59s	4.80s

28,700.56	5.06s	5.84s	6.06s	5.82s	5.23s	4.39s
31,412.91	5.17s	5.73s	5.79s	5.45s	4.81s	3.94s
34,168.03	5.15s	5.51s	5.44s	5.02s	4.34s	3.45s
36,965.93	5.01s	5.19s	5.01s	4.54s	3.83s	2.94s
39,808.39	4.77s	4.80s	4.53s	4.01s	3.29s	2.42s
42,696.12	4.45s	4.35s	4.00s	3.45s	2.73s	1.88s
45,629.14	4.06s	3.85s	3.43s	2.85s	2.14s	1.33s
48,607.74	3.62s	3.31s	2.84s	2.24s	1.54s	0.76s
51,631.28	3.13s	2.74s	2.22s	1.62s	0.94s	0.20s
54,700.44	2.60s	2.14s	1.60s	0.99s	0.33s	-0.37s
57,816.00	2.03s	1.53s	0.96s	0.35s	-0.28s	-0.93s
60,978.23	1.44s	0.91s	0.33s	-0.27s	-0.87s	-1.48s
64,187.13	0.82s	0.28s	-0.29s	-0.87s	-1.44s	-2.00s
67,442.59	0.16s	-0.37s	-0.91s	-1.45s	-1.98s	-2.48s
70,744.85	-0.56s	-1.04s	-1.52s	-2.00s	-2.46s	-2.90s
74,094.16	-1.35s	-1.76s	-2.15s	-2.54s	-2.90s	-3.24s

Distances in FEET.--Specific Gravity = 1.025.---------------

RIGHTING ARMS vs HEEL ANGLE

LCG = 324.30a TCG = 0.00 VCG = 39.97

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Righting Arms in Trim	in Heel	--> Area
23.200	0.00	0.00	19,789.77	0.00	0.000	0.00
23.124	0.01f	5.00s	19,789.77	0.00	0.788s	1.97
22.960	0.06f	10.00s	19,782.98	0.03f	1.468s	7.65
22.693	0.15f	15.00s	19,789.65	0.01a	2.053s	16.50
22.266	0.26f	20.00s	19,789.62	0.01a	2.612s	28.17
21.614	0.40f	25.00s	19,789.63	0.01a	3.179s	42.64
20.668	0.55f	30.00s	19,789.66	0.01a	3.775s	60.01
19.356	0.71f	35.00s	19,789.71	0.01a	4.414s	80.47
17.610	0.87f	40.00s	19,789.75	0.01a	5.142s	104.32
15.518	1.03f	45.00s	19,789.72	0.00	5.877s	131.86
13.344	1.21f	50.00s	19,788.32	0.00	6.193s	162.21
13.047	1.23f	50.67s	19,790.55	0.00	6.197s	166.38
11.072	1.38f	55.00s	19,785.05	0.02f	6.026s	192.96
8.706	1.54f	60.00s	19,789.76	0.00	5.470s	221.87

Distances in FEET.--Specific Gravity = 1.025.----Area in Ft-Deg.

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

LCG = 324.30a TCG = 0.00 VCG = 39.97

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	--> Area
23.200	0.00	0.00	19,789.77	0.00	-1.266s	0.00
23.166	0.00	2.50s	19,789.80	0.05a	-0.864s	-2.66
23.124	0.01f	5.00s	19,789.71	0.00	-0.478s	-4.34
23.051	0.03f	7.50s	19,789.56	0.00	-0.122s	-5.08
23.019	0.04f	8.44s	19,789.53	0.00	0.003s	-5.14
22.959	0.06f	10.00s	19,789.53	0.00	0.202s	-4.98
22.842	0.10f	12.50s	19,788.81	0.00	0.502s	-4.10
22.692	0.15f	15.00s	19,788.41	0.00	0.787s	-2.48
22.501	0.20f	17.50s	19,787.96	0.01a	1.066s	-0.17
22.264	0.26f	20.00s	19,787.55	0.01a	1.346s	2.85
21.972	0.33f	22.50s	19,787.15	0.00	1.627s	6.57
21.613	0.40f	25.00s	19,786.81	0.00	1.913s	10.99
21.182	0.48f	27.50s	19,786.53	0.00	2.207s	16.14
20.667	0.55f	30.00s	19,786.22	0.00	2.509s	22.03
20.061	0.63f	32.50s	19,785.91	0.00	2.823s	28.69
19.354	0.71f	35.00s	19,785.74	0.00	3.148s	36.16
18.539	0.79f	37.50s	19,785.76	0.00	3.493s	44.46
17.608	0.87f	40.00s	19,785.78	0.00	3.875s	53.67
16.578	0.95f	42.50s	19,786.47	0.00	4.278s	63.85
15.516	1.03f	45.00s	19,786.95	0.00	4.611s	74.97
14.425	1.12f	47.50s	19,787.46	0.00	4.858s	86.82
13.248	1.20f	50.00s	19,788.92	0.00	5.070s	99.24
11.950	1.27f	52.50s	19,789.47	0.01f	5.268s	112.16
10.533	1.33f	55.00s	19,789.49	0.00	5.465s	125.57
8.995	1.38f	57.50s	19,789.47	0.00	5.686s	139.51
7.341	1.42f	60.00s	19,789.58	0.00	5.959s	154.06

Distances in FEET.--Specific Gravity = 1.025.----Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the wind heeling arms derived from these moments (in Ft-LT):
Stbd. heeling moment = 25049.77Cos(heel) + 0.00|Sin(heel)|

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

LCG = 324.30a TCG = 0.00 VCG = 39.97

Origin Depth	Degrees of Trim	Degrees of Heel	Displacement Weight(LT)	Residual Arms in Trim	Residual Arms in Heel	--> Area
23.200	0.00	0.00	19,789.77	0.00	-2.198s	0.00
23.166	0.00	2.50s	19,789.80	0.05a	-1.804s	-5.00
23.124	0.01f	5.00s	19,789.71	0.00	-1.435s	-9.05
23.051	0.03f	7.50s	19,789.56	0.00	-1.096s	-12.20
22.959	0.06f	10.00s	19,789.22	0.00	-0.787s	-14.55
22.842	0.10f	12.50s	19,788.82	0.00	-0.502s	-16.16
22.692	0.15f	15.00s	19,788.41	0.00	-0.232s	-17.08
22.530	0.19f	17.20s	19,789.75	0.00	0.000s	-17.34
22.505	0.20f	17.50s	19,789.75	0.00	0.031s	-17.33
22.264	0.26f	20.00s	19,787.57	0.01a	0.295s	-16.92
21.972	0.33f	22.50s	19,787.15	0.00	0.560s	-15.85
21.613	0.40f	25.00s	19,786.81	0.00	0.831s	-14.11
21.182	0.48f	27.50s	19,786.53	0.00	1.107s	-11.69
20.667	0.55f	30.00s	19,786.22	0.00	1.393s	-8.57
20.061	0.63f	32.50s	19,785.92	0.00	1.689s	-4.72
19.354	0.71f	35.00s	19,785.74	0.00	1.996s	-0.11
18.539	0.79f	37.50s	19,785.76	0.00	2.324s	5.29
17.608	0.87f	40.00s	19,785.78	0.00	2.686s	11.55
16.578	0.95f	42.50s	19,786.47	0.00	3.069s	18.74
15.516	1.03f	45.00s	19,786.95	0.00	3.383s	26.81
14.425	1.12f	47.50s	19,787.46	0.00	3.629s	35.59
13.248	1.20f	50.00s	19,788.92	0.00	3.850s	44.93
11.950	1.27f	52.50s	19,789.47	0.01f	4.052s	54.81
10.533	1.33f	55.00s	19,789.49	0.00	4.246s	65.19
8.995	1.38f	57.50s	19,789.47	0.00	4.461s	76.07
7.341	1.42f	60.00s	19,789.58	0.00	4.724s	87.54

Distances in FEET.--Specific Gravity = 1.025.----Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the turn heeling arms for a 30.0 knot turn with a radius of 1000.0 Ft turning to the left.

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

LCG = 324.30a TCG = 0.00 VCG = 39.97

Origin Depth	Degrees of Trim	Heel	Displacement Weight(LT)	Residual Arms in Trim	in Heel	--> Area
23.200	0.00	0.00	19,789.77	0.00	-1.831s	0.00
23.166	0.00	2.50s	19,789.80	0.05a	-1.436s	-4.08
23.124	0.01f	5.00s	19,789.71	0.00	-1.065s	-7.21
23.051	0.03f	7.50s	19,789.56	0.00	-0.723s	-9.43
22.959	0.06f	10.00s	19,789.22	0.00	-0.411s	-10.85
22.842	0.10f	12.50s	19,788.82	0.00	-0.124s	-11.51
22.780	0.12f	13.64s	19,789.33	0.00	0.001s	-11.58
22.693	0.15f	15.00s	19,789.34	0.00	0.149s	-11.48
22.501	0.20f	17.50s	19,787.97	0.01a	0.415s	-10.78
22.264	0.26f	20.00s	19,787.56	0.01a	0.681s	-9.41
21.972	0.33f	22.50s	19,787.14	0.00	0.949s	-7.37
21.613	0.40f	25.00s	19,786.81	0.00	1.222s	-4.65
21.182	0.48f	27.50s	19,786.53	0.00	1.502s	-1.25
20.667	0.55f	30.00s	19,786.22	0.00	1.790s	2.86
20.061	0.63f	32.50s	19,785.91	0.00	2.089s	7.71
19.354	0.71f	35.00s	19,785.74	0.00	2.399s	13.32
18.539	0.79f	37.50s	19,785.76	0.00	2.730s	19.73
17.608	0.87f	40.00s	19,785.78	0.00	3.095s	27.01
16.578	0.95f	42.50s	19,786.46	0.00	3.482s	35.23
15.516	1.03f	45.00s	19,786.95	0.00	3.799s	44.33
14.425	1.12f	47.50s	19,787.46	0.00	4.045s	54.15
13.248	1.20f	50.00s	19,788.93	0.00	4.264s	64.54
11.950	1.27f	52.50s	19,789.47	0.01f	4.465s	75.45
10.533	1.33f	55.00s	19,789.49	0.00	4.660s	86.86
8.995	1.38f	57.50s	19,789.47	0.00	4.876s	98.78
7.341	1.42f	60.00s	19,789.58	0.00	5.141s	111.29

Distances in FEET.--Specific Gravity = 1.025.----Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the turn heeling arms for a 30.0 knot turn with a radius of 1200.0 Ft turning to the left.

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

LCG = 324.30a TCG = 0.00 VCG = 39.97

Origin Depth	Degrees of Trim	Degrees of Heel	Displacement Weight(LT)	Residual Arms in Trim	Residual Arms in Heel	--> Area
23.200	0.00	0.00	19,789.77	0.00	-1.831s	0.00
23.124	0.01f	5.00s	19,789.74	0.00	-1.065s	-7.24
22.965	0.06f	10.00s	19,789.88	0.02f	-0.412s	-10.88
22.787	0.12f	13.63s	19,789.75	0.03f	0.000s	-11.61
22.693	0.15f	15.00s	19,789.36	0.00	0.149s	-11.51
22.266	0.26f	20.00s	19,789.83	0.01a	0.681s	-9.42
21.614	0.40f	25.00s	19,789.88	0.01a	1.222s	-4.66
20.669	0.55f	30.00s	19,789.92	0.01a	1.791s	2.86
19.356	0.71f	35.00s	19,789.98	0.01a	2.400s	13.32
17.610	0.87f	40.00s	19,789.99	0.00	3.096s	27.02
15.518	1.03f	45.00s	19,789.84	0.00	3.798s	44.26
13.344	1.21f	50.00s	19,788.34	0.00	4.087s	64.14
13.144	1.22f	50.45s	19,790.97	0.00	4.089s	66.00
11.072	1.38f	55.00s	19,784.79	0.02f	3.901s	84.31
8.706	1.54f	60.00s	19,789.76	0.00	3.338s	102.57

Distances in FEET.--Specific Gravity = 1.025.----Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the turn heeling arms for a 30.0 knot turn with a radius of 1200.0 Ft turning to the left.

RESIDUAL RIGHTING ARMS vs HEEL ANGLE

LCG = 324.30a TCG = 0.00 VCG = 39.97

Origin Depth	Degrees of Trim	Degrees of Heel	Displacement Weight(LT)	Residual Arms in Trim	Residual Arms in Heel	--> Area
23.200	0.00	0.00	19,789.77	0.00	-0.625s	0.00
23.128	0.00f	3.92s	19,782.50	0.05a	0.000s	-1.23
23.119	0.01f	5.00s	19,783.89	0.01f	0.163s	-1.14
22.961	0.06f	10.00s	19,789.73	0.01f	0.843s	1.42
22.693	0.15f	15.00s	19,789.65	0.01a	1.428s	7.14
22.266	0.26f	20.00s	19,789.62	0.01a	1.987s	15.69
21.614	0.40f	25.00s	19,789.63	0.01a	2.554s	27.04
20.668	0.55f	30.00s	19,789.66	0.01a	3.151s	41.28
19.356	0.71f	35.00s	19,789.71	0.01a	3.789s	58.62
17.610	0.87f	40.00s	19,789.75	0.01a	4.517s	79.34
15.518	1.03f	45.00s	19,789.72	0.00	5.252s	103.76
13.344	1.21f	50.00s	19,788.32	0.00	5.568s	130.99
13.046	1.23f	50.68s	19,790.46	0.00	5.572s	134.75
11.072	1.38f	55.00s	19,785.06	0.02f	5.401s	158.61
8.706	1.54f	60.00s	19,789.76	0.00	4.845s	184.40

Distances in FEET.--Specific Gravity = 1.025.----Area in Ft-Deg.

Note: The Residual Righting Arms shown above are in excess of the wind heeling arms derived from these moments (in Ft-LT):
Stbd. heeling moment = 12365.99Cos(heel) + 0.00|Sin(heel)|

LONGITUDINAL STRENGTH

LOCATION Ft	WEIGHT LT/Ft	BUOYANCY LT/Ft	SHEAR LT	MOMENT LT-Ft
0.25f	0.00	0.00	0.0	0
0.00	0.00	0.01	0.0	0
0.00	0.10	0.01	0.0	0
4.90a	1.01	0.61	-1.2	4
9.81a	1.93	1.27	-3.8	18
26.14a	4.97	3.86	-18.3	195
42.46a	8.00	6.57	-39.0	661
58.78a	11.04	9.52	-63.2	1,499
75.11a	14.08	13.01	-84.4	2,720
90.00a		16.22	-97.1	4,084
90.00a	0.66*	16.22	-97.7	4,084
91.43a	17.12	16.53	-98.6	4,225
107.76a	20.16	19.98	-104.9	5,901
124.09a	23.20	23.53	-103.7	7,622
140.42a	26.24	27.15	-93.6	9,252
156.74a	29.28	30.70	-74.6	10,643
173.07a	32.32	34.20	-47.7	11,658
189.40a	35.36	37.58	-14.2	12,177
205.72a	38.40	40.82	23.7	12,111
215.00a	40.13	42.53	46.1	11,791
222.04a	40.13	43.83	67.6	11,399
228.00a		44.84	92.7	10,927
228.00a	136.40*	44.84	-43.7	10,927
238.37a	40.13	46.59	14.2	11,099
248.00a		48.03	83.4	10,644
248.00a	100.00*	48.03	-16.6	10,644
250.00a		48.33	-0.5	10,662
250.00a	66.00*	48.33	-66.5	10,662
254.70a	40.13	49.03	-26.3	10,883
271.02a	40.13	51.09	135.9	10,041
287.35a	40.13	52.68	327.9	6,297
300.00a		53.57	492.4	1,123
300.00a	66.00*	53.57	426.4	1,123
303.67a	40.13	53.82	476.2	-531
319.99a	40.13	54.39	704.4	-10,149
324.00a		54.41	761.6	-13,083
324.00a	1,050.00*	54.41	-288.4	-13,083
330.00a		54.43	-202.6	-11,608
330.00a	260.00*	54.43	-462.6	-11,608
336.32a	40.13	54.46	-372.1	-8,967
347.00a		54.10	-221.0	-5,799
347.00a	0.66*	54.10	-221.7	-5,799
352.64a	40.13	53.90	-143.3	-4,767
363.00a		53.11	-4.8	-4,004
363.00a	402.00*	53.11	-406.8	-4,004
368.97a	40.13	52.65	-330.6	-1,802
385.30a	40.13	50.72	-141.9	2,020

LOCATION	WEIGHT	BUOYANCY	SHEAR	MOMENT
Ft	LT/Ft	LT/Ft	LT	LT-Ft
401.63a	40.13	48.63	14.1	3,023
410.00a		47.20	79.3	2,627
410.00a	66.00*	47.20	13.3	2,627
420.66a	40.13	45.39	79.0	2,122
425.00a	40.13	44.53	100.0	1,733
439.69a	37.26	41.62	164.4	-204
450.00a		39.35	208.0	-2,121
450.00a	260.00*	39.35	-52.0	-2,121
458.72a	33.54	37.43	-17.2	-1,818
477.75a	29.83	33.09	50.8	-2,150
496.78a	26.11	28.58	105.4	-3,653
515.81a	22.40	24.37	147.6	-6,068
534.84a	18.68	20.38	182.6	-9,211
547.00a		18.10	203.9	-11,555
547.00a	240.00*	18.10	-36.1	-11,555
553.88a	14.96	16.81	-23.6	-11,347
560.00a		15.84	-11.6	-11,236
560.00a	260.00*	15.84	-271.6	-11,236
572.91a	11.25	13.81	-241.6	-7,912
591.94a	7.53	11.09	-183.3	-3,831
610.97a	3.82	8.54	-104.5	-1,050
630.00a	0.10	6.36	0.0	-3
630.00a	0.00			

* Point weight in LONG TONS----------------------------

S U M M A R Y

Max. Shear:	761.6 LT	at	324.00a
Max. Bending Moment:	-13,083 LT-Ft	at	324.00a (Sagging)

FLOODABLE LENGTHS

Initial Origin Depth = 23.20 Initial Trim = 0.00 Degrees
Vertical C.G. = 39.97 Permeability =0.900

ORIGIN DEPTH	Deg TRIM	FLOODED CENTER	FLOODED LENGTH	MARGIN	GMt
51.19	-3.51	80.00	230.04	9.25	3.75
51.19	-3.51	96.00	198.90	9.25	3.76
51.21	-3.47	112.00	180.27	9.25	4.00
51.25	-3.40	128.00	169.78	9.25	3.85
51.29	-3.31	144.00	163.70	9.25	3.74
51.33	-3.21	160.00	160.89	9.25	4.26
51.38	-3.10	176.00	160.32	9.25	4.34
51.44	-2.99	192.00	164.23	9.25	4.66
51.49	-2.86	208.00	171.48	9.25	5.05
51.57	-2.71	224.00	180.68	9.25	4.82
51.66	-2.49	240.00	192.78	9.25	4.73
51.87	-2.04	256.00	212.22	9.25	5.49
52.12	-1.47	272.00	236.10	9.25	8.02
52.40	-0.82	288.00	263.89	9.25	10.84
52.72	-0.06	304.00	296.48	9.25	13.90
45.12	0.69	320.00	273.12	9.25	11.72
38.34	1.31	336.00	249.47	9.25	9.86
32.78	1.81	352.00	229.46	9.25	8.61
28.24	2.23	368.00	212.91	9.25	7.76
24.95	2.52	384.00	196.99	9.25	6.93
22.17	2.78	400.00	184.31	9.25	6.16
19.78	2.99	416.00	174.65	9.25	5.43
17.62	3.19	432.00	167.14	9.25	4.71
15.79	3.36	448.00	161.79	9.25	3.97
14.14	3.50	464.00	157.57	9.25	3.24
12.69	3.64	480.00	154.74	9.25	2.49
11.37	3.76	496.00	152.91	9.25	1.73
10.18	3.86	512.00	152.02	9.25	0.98
9.15	3.96	528.00	151.75	9.25	0.23
8.18	4.04	544.00	152.17	9.25	-0.51
7.65	4.09	560.00	165.39	9.25	-0.96

FLOODABLE LENGTHS
Initial Origin Depth = 23.20 Initial Trim = 0.00 Degrees
Vertical C.G. = 0.00 Permeability =0.800

ORIGIN DEPTH	Deg TRIM	FLOODED CENTER	FLOODED LENGTH	MARGIN	GMt
51.25	-3.39	96.00	245.84	9.25	43.89
51.25	-3.38	112.00	217.04	9.25	43.96
51.28	-3.33	128.00	201.45	9.25	44.25
51.31	-3.25	144.00	192.46	9.25	44.14
51.36	-3.16	160.00	188.14	9.25	44.16
51.41	-3.06	176.00	188.55	9.25	44.81
51.46	-2.95	192.00	193.47	9.25	44.63
51.51	-2.82	208.00	200.85	9.25	44.93
51.59	-2.66	224.00	210.58	9.25	45.17
51.69	-2.43	240.00	224.43	9.25	44.60
51.91	-1.96	256.00	246.41	9.25	45.87
52.14	-1.42	272.00	272.78	9.25	48.19
52.41	-0.81	288.00	303.51	9.25	50.68
52.70	-0.11	304.00	339.14	9.25	53.24
45.95	0.62	320.00	316.05	9.25	51.49
39.34	1.22	336.00	288.04	9.25	49.63
33.88	1.71	352.00	264.95	9.25	48.34
29.34	2.13	368.00	245.79	9.25	47.44
25.68	2.46	384.00	229.51	9.25	46.74
22.95	2.71	400.00	214.83	9.25	45.98
20.55	2.92	416.00	203.54	9.25	45.26
18.41	3.12	432.00	194.61	9.25	44.55
16.56	3.29	448.00	188.22	9.25	43.83
14.89	3.44	464.00	183.25	9.25	43.11
13.37	3.57	480.00	179.95	9.25	42.37
12.05	3.69	496.00	177.75	9.25	41.63
10.85	3.80	512.00	176.61	9.25	40.88
9.78	3.90	528.00	176.41	9.25	40.12
8.97	3.97	544.00	182.03	9.25	39.46

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FLOODABLE LENGTHS

Initial Origin Depth = 23.20 Initial Trim = 0.00 Degrees
Vertical C.G. = 0.00 Permeability =0.700

ORIGIN DEPTH	Deg TRIM	FLOODED CENTER	FLOODED LENGTH	MARGIN	GMt
51.30	-3.28	112.00	271.25	9.25	43.92
51.31	-3.27	128.00	244.09	9.25	44.03
51.33	-3.21	144.00	230.19	9.25	44.41
51.37	-3.13	160.00	225.38	9.25	44.46
51.41	-3.04	176.00	225.96	9.25	44.66
51.46	-2.93	192.00	230.98	9.25	44.98
51.52	-2.80	208.00	238.46	9.25	45.21
51.60	-2.64	224.00	249.13	9.25	44.95
51.71	-2.39	240.00	264.89	9.25	44.37
51.92	-1.92	256.00	291.49	9.25	46.08
52.15	-1.40	272.00	323.01	9.25	48.24
52.41	-0.81	288.00	359.82	9.25	50.39
52.69	-0.14	304.00	403.35	9.25	52.48
46.59	0.56	320.00	377.03	9.25	51.03
40.10	1.15	336.00	341.02	9.25	49.23
34.66	1.64	352.00	311.66	9.25	47.93
30.09	2.06	368.00	287.80	9.25	46.99
26.26	2.41	384.00	268.37	9.25	46.33
23.21	2.68	400.00	251.74	9.25	45.71
20.82	2.90	416.00	237.96	9.25	45.04
18.70	3.09	432.00	226.66	9.25	44.37
16.80	3.26	448.00	218.26	9.25	43.71
15.12	3.42	464.00	212.36	9.25	43.02
13.63	3.55	480.00	208.35	9.25	42.31
12.28	3.67	496.00	204.96	9.25	41.61
11.05	3.78	512.00	203.60	9.25	40.88
10.00	3.88	528.00	203.52	9.25	40.12

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